BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

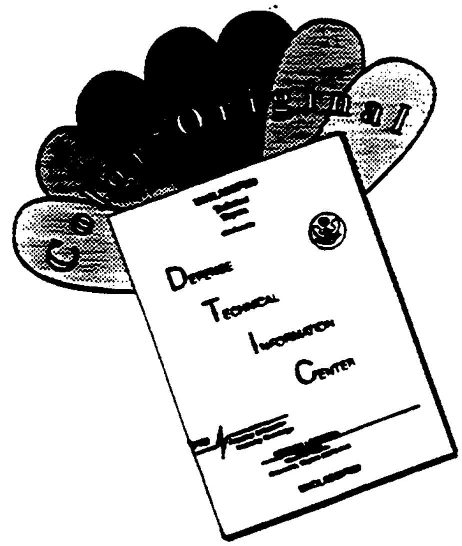
(Base year through FY1996)

19970527 143

U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

Baton Rouge, Louisiana
1997

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF COLOR PAGES WHICH DO NOT REPRODUCE LEGIBLY ON BLACK AND WHITE MICROFICHE.

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers New Orleans District (USACE-NOD) maintains eleven major navigation channels in Louisiana that require regular maintenance dredging (Figure 1). More than 90 million cubic yards of sediment is dredged annually and the USACE-NOD coordinates with state and federal natural resource agencies to determine the most appropriate methods for the disposal of dredged material and where possible, to beneficially use this material to create or enhance wetlands and other habitats. The USACE-NOD has developed long-term disposal plans incorporating beneficial use for each of these navigation channels. The USACE-NOD working in cooperation with Louisiana State University (LSU) - Coastal Studies Institute, implemented a large-scale monitoring program in 1994 to quantify the amount of new habitat created and to improve dredge disposal placement techniques to maximize beneficial use. This monitoring program is known as the USACE-NOD/LSU Beneficial Use of dredged material Monitoring Program (BUMP).

Vertical aerial photography was acquired in October/November 1995, and color mosaics were produced for all sites listed in table 2; monitoring and analysis was continued and updated for Baptiste Collette Bayou, the Lower Atchafalaya River Bay and Bar, and Mississippi River Gulf Outlet (MRGO) jetties and Breton Island; full field effort including ground-truthing, establishing profile benchmarks, and profile data acquisition was implemented for MRGO - Mile 50-60, Houma Navigation Canal - Bay Chaland and Lower Atchafalaya River - Horseshoe.

Vertical photography was acquired in November 1996, and digital color mosaics were produced for all sites listed in table 2. GIS habitat analysis was completed for MRGO - Mile 50-60, MRGO - Jetties, Baptiste Collette Bayou, Southwest Pass, Houma Navigation Canal - Bay Chaland, Atchafalaya River Bay and Bar, Lower Atchafalaya River - Horseshoe, with shoreline data for MRGO-Breton Island. Since the most recent aerial photography was flown in November 1996, most data and results of the 1996 Final Report reflected maintenance events that occurred through FY96.

The work products include habitat maps for the benchmark year and habitat maps for the selected monitoring years. Habitat change maps were produced for each time interval of comparison. From this analysis, coastal change data quantified the creation of new coastal lands and other habitats at selected navigation channel locations. The field program included ground truthing operations to verify and update the habitat maps and field surveys to collect information about vegetation, disposal elevations, and placement practices which maximize beneficial use.

The results of the 1996 Year 1 Beneficial Use of dredged material Monitoring Program (BUMP) are presented in a nine part report compiled in this binder:

Part 1: Introduction and Methodology
Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass
Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Channel, Louisiana - Bay Chaland
Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Balck, Louisiana - Lower Atchafalaya River Horseshoe
Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

In addition, the BUMP has generated a map series in support of the 1996 Final Report and these are listed below.

Map Series #1: Habitat and Shoreline Changes of the Mississippi River Gulf Outlet, Louisiana - Mile 47-59: 1990 to 1996
Map Series #2: Habitat and Shoreline Changes of the Mississippi River Gulf Outlet, Louisiana - Jetties: 1985 to 1996
Map Series #3: Shoreline Changes of the Mississippi River Gulf Outlet, Louisiana - Breton Island: 1985 to 1996
Map Series #4: Habitat and Shoreline Changes of the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou: 1975 to 1996
Map Series #5: Habitat Inventory of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass: 1985
Map Series #6: Habitat Inventory of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass: February 1995
Map Series #7: Habitat Inventory of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass: November 1995
Map Series #8: Habitat Inventory of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass: 1996
Map Series #9: Habitat and Shoreline Changes of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass: 1985 to 1996
Map Series #10: Shoreline Changes of the Houma Navigation Canal, Louisiana - Bay Chaland: 1985 to 1996

Map Series #11: Habitat and Shoreline Changes of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe: 1985 to 1996

Map Series #12: Habitat Inventory of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel: 1995

Map Series #13: Habitat Inventory of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel: 1996

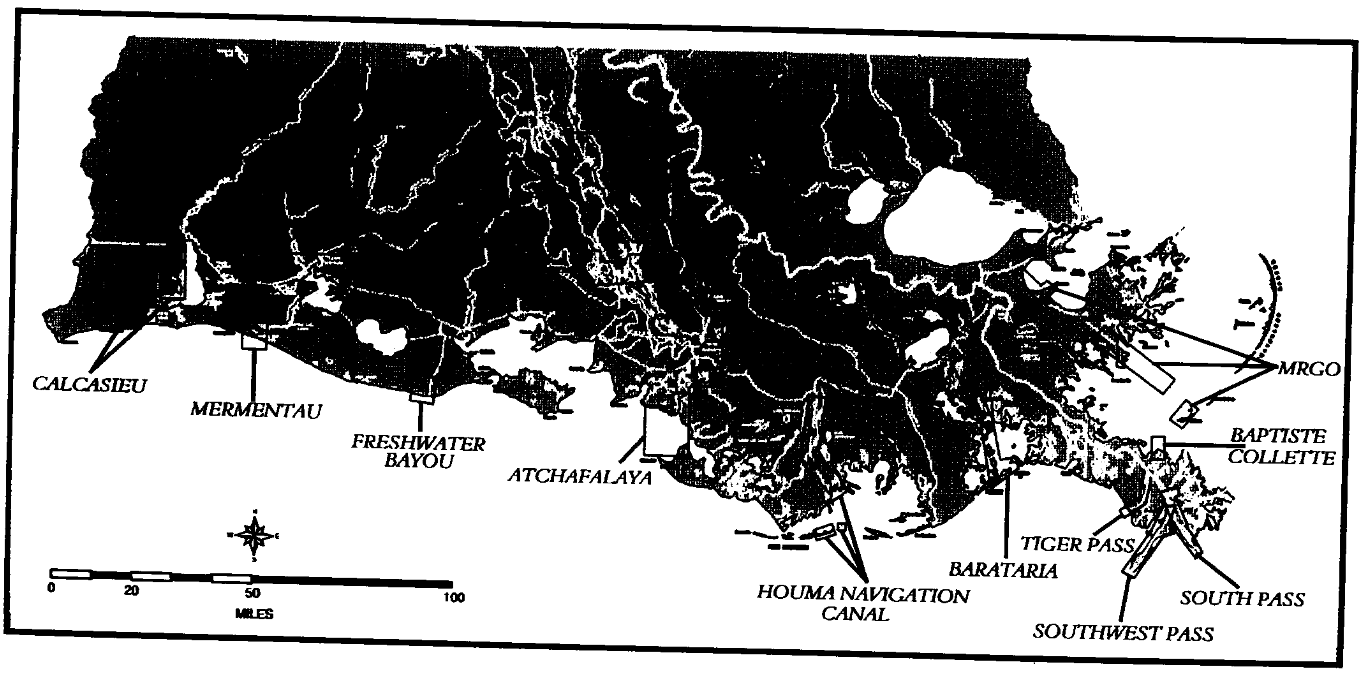
Map Series #14: Habitat and Shoreline Changes of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel: 1985 to 1996

U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

(Base year through FY1996)

Part 1: Introduction and Methodology



Shea Penland and Karen A. Westphal
Coastal Studies Institute
Louisiana State University
Baton Rouge, LA 70803
1997

TABLE OF CONTENTS

INTRODUCTION 1-1
- Beneficial Use of Dredged Material Monitoring Program Description 1-1
- The Monitoring Program 1-3
- 1996 Report and Products 1-6

WORK PLAN 1-8
- Aerial Photographic Analysis 1-8
  - 1) Photo Acquisition 1-8
  - 2) Photo Mosaicing 1-8
  - 3) Photo Interpretation and Digitization 1-8
  - 4) Habitat Classification 1-9
  - 5) Groundtruthing 1-11
- Field Program 1-11
  - 1) Ground Truthing 1-11
  - 2) Field Monitoring 1-11
- Geographic Information System (GIS) Analysis 1-12
- World Wide Web Site 1-12

WORK PRODUCTS 1-13
- 1) Aerial Photography 1-13
- 2) Photo Mosaics 1-13
- 3) Habitat Inventory Maps 1-13
- 4) Shoreline Change Maps 1-13
- 5) Habitat Change Maps 1-13
- 6) Change Data Matrices 1-13
- 7) Dredged Material Disposal History Map 1-14
- 8) Habitat Creation and Configuration Monitoring Results 1-14
- 9) Coordination 1-14
- 10) Annual Report 1-14
- 11) BUMP Archive and LSU Facilities 1-14
- 12) World Wide Web Site 1-14

SUMMARY 1-15

REFERENCES 1-15

APPENDIX 1A: BASE MAPS 1A-1

LIST OF FIGURES

Figure 1. Locations of the beneficial use of dredged material monitoring areas. . . . 1-1

LIST OF TABLES

TABLE 1
Beneficial Use of Dredged Materials Monitoring Program Research Staff 1-2

TABLE 2
USACE-NOD Large-Scale Wetland Creation Monitoring Program Implementation Schedule 1-3

TABLE 3
Schedule for USACE-NOD Beneficial Use of Dredged Material Monitoring Program 1-4

INTRODUCTION

Beneficial Use of Dredged Material Monitoring Program Description

The U.S. Army Corps of Engineers New Orleans District (USACE-NOD) maintains eleven major navigation channels in Louisiana that require regular maintenance dredging (Figure 1). More than 90 million cubic yards of sediment is dredged annually and the USACE-NOD coordinates with state and federal natural resource agencies to determine the most appropriate methods for the disposal of dredged material and where possible, to beneficially use this material to create or enhance wetlands and other habitats. The USACE-NOD has developed long-term disposal plans incorporating beneficial use for each of these navigation channels. The USACE-NOD working in cooperation with Louisiana State University (LSU) - Coastal Studies Institute, implemented a large-scale monitoring program in 1994 to quantify the amount of new habitat created and to improve dredge disposal placement techniques to maximize beneficial use. This monitoring program is known as the USACE-NOD/LSU Beneficial Use of dredged material Monitoring Program (BUMP). The research staff for this program is listed in Table 1.

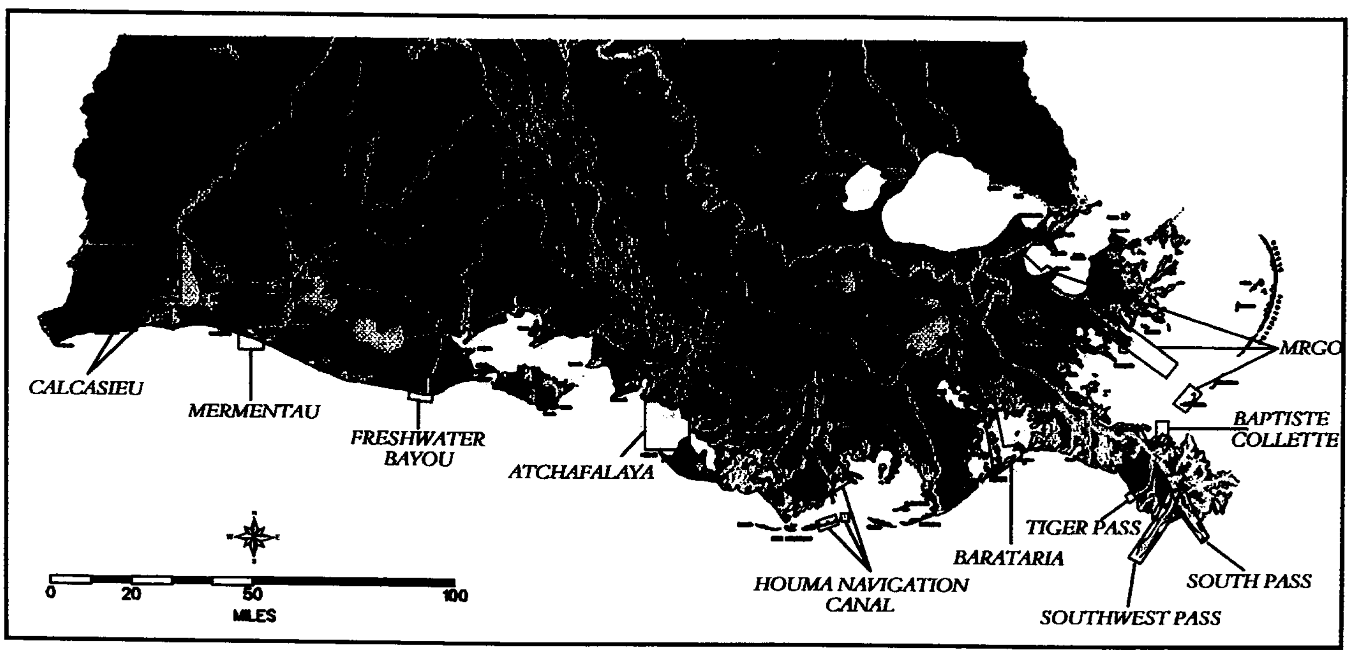


Figure 1. Locations of the beneficial use of dredged material monitoring areas.

TABLE 1
Beneficial Use of Dredged Materials Monitoring Program Research Staff

U.S. Army Corps of Engineers

- Dr. Linda Mathies - Environmental Resources Specialist
- Beth Nord - Environmental Resources Specialist
- Chris Accardo/Bill Caver - Project Engineer
- John Flanagan - Project Engineer
- Bob Gunn - Project Engineer
- Fred Schilling/Tim Roth - Project Engineer

Louisiana State University

- Dr. Shea Penland - Coastal Geologist
- Karen A. Westphal - Coastal Ecologist/Project Manager
- Lynda Wayne - GIS Specialist
- Qiang Tao - GIS Specialist
- Chris Zganjar - GIS Specialist
- Paul Connor - Geologist
- Jamie Phillippe - Geographer/photo-interpretation
- Robert Seal - Logistics Manager
- Elaine Evers - Coastal Ecologist/photo-interpretation
- Ashley Stokes - Coastal Ecologist/photo-interpretation
- Jenneke Vissar - Coastal Ecologist/field support
- Gary Peterson - Coastal Ecologist/Field support

LUMCON

- Dr. Denise Reed - Wetland Specialist

The Monitoring Program

The monitoring program uses remote sensing and field data acquisition strategies developed by the Baptiste Collette pilot study (Wayne et al., 1995) and refined in 1995. Table 2 lists the implementation schedule for the USACE-NOD beneficial use of dredged material monitoring program. This includes USACE-NOD and natural resources agency coordination, aerial photographic analysis, geographical information system (GIS) analysis, ground truthing, field monitoring, and the production of work products. Table 3 lists the data collection and analysis elements of the USACE-NOD monitoring program. The base year in Table 3 is the year chosen to begin GIS monitoring using aerial photography which ranges in date from 1976 for Baptiste Collette to 1992 for Calcasieu. Other dates are estimated for planning purposes and actual dates may vary due to weather or other unforeseen events. In 1997, the implementation of the large-scale monitoring program will be completed and will move from the implementation phase to the operation and maintenance phase.

TABLE 2

USACE-NOD Large-Scale Wetland Creation Monitoring Program Implementation Schedule

NAVIGATION CHANNEL	IMPLEMENTATION DATE	
	site specific aerial photography	field monitoring
1. Baptiste Collette Bayou	1993	1993
2. Lower Atchafalaya River		
Bay and Bar	fall 94	spring 95
Horseshoe Channel	fall 95	fall 96
Avoca Lake	fall 95	—
3. Mississippi River Gulf Outlet		
Mile 50-60	spring 95	fall 96
Jetties & Breton Island	spring 95	spring 95
4. Houma Navigation Canal		
Bay Chaland	spring 95	fall 96
Wine Island, East Island	spring 95	--
5. Southwest Pass	spring 95	summer 97
6. South Pass	spring 95	summer 95
7. Tiger Pass	spring 95	summer 97
8. Freshwater Bayou	spring 95	summer 97
9. Barataria Bay Waterway	spring 95	summer 97
10. Mermentau River - Mud Lake & Mermentau Beach	fall 95	summer 97
11. Calcasieu River - Brown Lake & Sabine	fall 95	summer 97

TABLE 3
Schedule for USACE-NOD Beneficial Use of Dredged Materials Monitoring Program
December 20, 1996

Navigation Channel	Engineer	Base Year	Disposal Since Base Year	Air Photo Acquisition	Air Photo Mosaic[3]	AP[4] Analysis[3]	Ground Truthing[3]	GIS Analysis[3,5]	Field Monitoring[3]	Dredging Conference [2]	Report
1. MRGO - Inside (Mi 50-60)	Bob Gunn	1990	1988 5Feb-26Jun 93 5Dec95-3Feb96	8Feb95 9Nov95 8Nov96	May 96 Feb 97	Jun 96 Feb 97	Nov 96	Jun 96 Mar 97	Nov 96	May 97	May 97
1. MRGO - Jetties (Mi 0-30)	Bob Gunn	1985	1993 1Jul-21Dec93 12Jul-29Aug94 18Jun-31Jul95 19Dec95-29Jan96 9May-17Jun96	8Feb95 9Nov95 8Nov96	Mar 95 May 96 Feb 97	Aug 95 Mar 96 Feb 97	May 95 Apr 96 Jun/Nov 96	Sep 95 Jun 96 Mar 97	May 95 Jun/Nov 96	May 96 May 97	May 96 May 97
1. MRGO - Breton Island (Mi -3 to -9)	Bob Gunn	1990	1984 4Oct91-9Mar92 Sep-Nov93 Sep-Nov94 22Aug-25Sep96	28Apr95 9Nov95 8Nov96 Pre/post 97	Mar 95 May 96 Feb 97	Feb 96 Feb 97	Feb 96	April 96 April 97	May 95 Aug 96	May 96 May 97	May 96 May 97
2. Baptiste Collette Bayou	Bob Gunn	1976	Jun-Oct 1994 2May-17May95 17May-21Sep95 31Aug-21Sep95 31Jul-16Sep96	11Nov94 9Nov95 8Nov96	Mar 95 May 96 Jan 97	May 95 May 96 Feb 97	Aug 95 Feb 96	Jun 95 May 96 Feb 97	Aug 95 Aug 96	June 95 May 96 May 97	Sept 94 June 95 May 96 May 97
3. South Pass	Fred Schilling	1985	Sep-Oct 1994	31Jan+28Apr95 9Nov95 9Nov96	May 95 May 96 Mar 97	Sep 95 Jun 96 Jun 97	Sep 95 Jun 96 Aug 97	Sep 95 Jun 96 Jun 97	Aug 95	May 96 May 98	May 96 May 98
4. Southwest Pass	Fred Schilling	1985	Mar-Oct 1994 4Sep95 Mar-Oct95 5Jun-4Sep95 24May-9Aug96	31Jan+28Apr95 12Nov 95 8Nov 96	May 95 May 96 Feb 97	Sep 95 Jun 96 Mar 97	Jun 95 Mar 97	Sep 95 Mar 97		May 97	May 96 May 97
5. Tiger Pass (Mi 6.2-9.5)	Bob Gunn	1985	7Dec93-26Jan94	8Feb 95 9Nov95 8Nov 96	Mar 95 May 96 Mar 97	Jun 96[5] Aug 97	Jul 96 Aug 97	July 96 Aug 97	Aug 97	May 98	May 98
6. Barataria Waterway - Queen Bess (Mi 2.6-12.1)	Bob Gunn	1985	1991 1Oct-3Dec96	8Feb 95 12Nov 95 9Nov 96	Mar 95 May 96 Mar 97	Aug 97	Aug 97	Aug 97	Aug 97	May 98	May 98
6. Barataria Waterway - Grand Terre Island	Bob Gunn	1985	19Aug-5Sep96	8Feb 95 12Nov 95 9Nov 96	Mar 95 May 96 Mar 97	Aug 97	Aug 97	Aug 97	Aug 97	May 98	May 98

(Table 4 continued on the next page)

TABLE 4 (cont'd)
Schedule for USACE-NOD Beneficial Use of Dredged Materials Monitoring Program
December 20, 1996

Navigation Channel	Engineer	Base Year	Disposal Since Base Year	Air Photo Acquisition[3]	Air Photo Mosaic[3]	AP[4] Analysis[3]	Ground Truthing[3]	GIS Analysis[3,5]	Field Monitoring[3]	Dredging Conference[2]	Annual Report
6. Barataria Waterway - Dupre Cut (Mi 32-27)	Bob Gunn	1985	none	8Feb 95 12Nov95 9Nov 96	Mar 95 May 96 Mar 97						
6. Barataria Waterway - Beauregard Is. to Bayou St. Denis	Bob Gunn	1985		8Feb 95 12Nov95 9Nov 96	Mar 95 May 96 Mar 97	Aug 97	Aug 97	Aug 97	Aug 97	May 98	May 98
7. Houma Nav. Canal Chaland Bay	Bob Gunn	1990	17Sep-7Nov93 29Sep-21Nov95 18Sep-19Nov95	8Feb+2Apr95 28Oct95 10Nov 96	Mar 95 May 96 Mar 97	Apr 96 Feb 97	19, 26Sep96	Jun 96 Feb 97	Sep 96	May 97	May 97
7. Houma Nav. Canal Cat Island Pass	Bob Gunn	1990	28Aug93-11Oct94 6May-10Jun95	8Feb+28Apr95 28Oct95 10Nov 96	Mar 95 May 96 Mar 97	Apr 96 Feb 97	Apr 97	Feb 97		May 98	May 98
8. Lower Atchafalaya River Bay and Bar	John Flanagan	1985	Jun-Oct 1994 28Aug-25Oct95 14Apr-11May95 24Jun-26Oct95 26Jul-28Aug95 16Apr-14Jul96 28Jul-16Dec96	11Nov 94 28Oct 95 10Nov 96	Jan 95 Mar 96 Feb 97	Apr 95 Jun 96 Feb 97	May 95 Sept 96	Jun 95 Jun 96 Mar 97	May 95 Aug/Oct 96 Aug 97	June 95 May 96 May 97	May 96 May 97
8. Lower Atchafalaya Channel (Horseshoe)	John Flanagan	1985	27May-16Oct94 12May-21Jun95 18Apr-16May96 17Aug-25Oct96 28Jul-16Dec96	28Oct 95 10Nov96+16Feb97	Mar 96 Feb 97	Jun 96 Feb 97	Oct 96	Jun 96 Mar 97	Oct 96	May 97	May 97
8. Atchafalaya Avoca Lake	John Flanagan	1985		28Oct 95 10Nov 96	Mar 96 Feb 97	Aug 97	Aug 97	Aug 97	Aug 97	May 98	May 98
9. Freshwater Bayou/Beach	Chris Accardo	1993 1990	30Jan-4Mar83 14Sep-17Oct90 27Mar-29Apr94	8Feb95 28Oct95 10Nov 96	Mar 95 May 96 Apr 97	Aug 97[5]	Sep 97	Sep 97[5]	Sep 97[5]	May 98	May 98
10. Mermentau River - Lake and Beach	Chris Accardo	1990	22Jun-16Jul 87 29Apr-10Jun 91 21Apr-22May96	28Oct 95 10Nov 96	May 96 Mar 97	Sep 97[5]	Sep 97	Sep 97[5]	Sep 97	May 98	May 98
11. Calcasieu River and Pass	Chris Accardo	1992	12Jun-20Oct 93 15Sep-10Oct93 1Jul96-17Jan97	28Oct 95 10Nov 96	May 96 Mar 97	Aug 97[5]	Aug 97	Aug 97	Aug 97	May 98	May 98

[1]Shoreline only, no habitats interpreted.
AD* To be done after dredging is completed, instead of or in addition to October. Check with project engineer.
[3]LSU is responsible for notification and performance.
[4]Aerial Photographic
[5]Geographic Information System Analysis

1996 Report and Products

Vertical aerial photography was acquired in October/November 1995, and color mosaics were produced for all sites listed in table 2; monitoring and analysis was continued and updated for Baptiste Collette Bayou, the Lower Atchafalaya River Bay and Bar, and Mississippi River Gulf Outlet (MRGO) jetties and Breton Island; full field effort including ground-truthing, establishing profile benchmarks, and profile data acquisition was implemented for MRGO - Mile 50-60, Houma Navigation Canal - Bay Chaland and Lower Atchafalaya River - Horseshoe.

Vertical photography was acquired in November 1996, and digital color mosaics were produced for all sites listed in table 2. GIS habitat analysis was completed for MRGO - Mile 50-60, MRGO - Jetties, Baptiste Collette Bayou, Southwest Pass, Houma Navigation Canal - Bay Chaland, Atchafalaya River Bay and Bar, Lower Atchafalaya River - Horseshoe, with shoreline data for MRGO-Breton Island. Since the most recent aerial photography was flown in November 1996, most data and results of the 1996 Final Report reflected maintenance events that occurred through FY96.

The work products include habitat maps for the benchmark year and habitat maps for the selected monitoring years. Habitat change maps were produced for each time interval of comparison. From this analysis, coastal change data quantified the creation of new coastal lands and other habitats at selected navigation channel locations. The field program included ground truthing operations to verify and update the habitat maps and field surveys to collect information about vegetation, disposal elevations, and placement practices which maximize beneficial use.

The results of the 1996 Beneficial Use of dredged material Monitoring Program (BUMP) is presented in a nine part report:

- Part 1: Introduction and Methodology
- Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
- Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
- Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
- Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana Baptiste Collette Bayou
- Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana Southwest Pass
- Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Channel, Louisiana - Bay Chaland
- Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe
- Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

In addition, the BUMP has generated a map series in support of the 1996 Final Report and these are listed below.

- Map Series #1: Habitat and Shoreline Changes of the Mississippi River Gulf Outlet, Louisiana - Mile 47-59: 1990 to 1996
- Map Series #2: Habitat and Shoreline Changes of the Mississippi River Gulf Outlet, Louisiana - Jetties: 1985 to 1996
- Map Series #3: Shoreline Changes of the Mississippi River Gulf Outlet, Louisiana - Breton Island: 1985 to 1996
- Map Series #4: Habitat and Shoreline Changes of the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou: 1975 to 1996
- Map Series #5: Habitat Inventory of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass: 1985
- Map Series #6: Habitat Inventory of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass: February 1995
- Map Series #7: Habitat Inventory of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass: November 1995
- Map Series #8: Habitat Inventory of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass: 1996
- Map Series #9: Habitat and Shoreline Changes of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass: 1985 to 1996
- Map Series #10: Shoreline Changes of the Houma Navigation Canal, Louisiana - Bay Chaland: 1985 to 1996
- Map Series #11: Habitat and Shoreline Changes of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe: 1985 to 1996
- Map Series #12: Habitat Inventory of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel: 1995
- Map Series #13: Habitat Inventory of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel: 1996
- Map Series #14: Habitat and Shoreline Changes of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel: 1985 to 1996

WORK PLAN

Aerial Photographic Analysis

The aerial photographic analysis involved five major steps, 1) photo acquisition, 2) photo mosaicing, 3) photo interpretation and digitization, 4) habitat classification, and 5) ground truthing.

1) Photo Acquisition

LSU's air photo contractor acquired photography of each BUMP site at the end of the USACOE-NOD maintenance year which corresponds to the end of the growing season to capture the maximum vegetation extent for that year. Color infrared photography was acquired at a scale of 1:24,000. There was a 60 percent forward overlap of the photography which allowed the use of stereo plotting techniques for better accuracy. Color infrared photography was used for mapping and photo-interpretation because it provided a better definition of vegetation types, habitats, and the land/water interface. LSU archived a copy of the color infrared photography at the Coastal Studies Institute in the Center for Coastal, Energy, and Environmental Resources (CCEER). A second set of color infrared photography was provided to the USACE-NOD.

2) Photo Mosaicing

The aerial photography acquired for each dredge disposal site was mosaiced for use by the USACE-NOD and LSU. The air photo mosaic was produced by scanning the photography into a digital database, rectifying to scale, and edge matching the photography to provide a complete image of the beneficial use disposal site. A color computer plot was made of the mosaiced image at a scale of 1:24:0006. The digital file can be used to overlay other USACE-NOD information as needed. The mosaics were delivered to the USACE-NOD as a hard copy plot and as a digital file on a CD ROM in Intergraph MGE format.

3) Photo Interpretation and Digitization

The study areas were interpreted and mapped from the base year photography and the color infrared aerial photography using a Bausch and Lomb Zoom Transfer Scope. USGS quadrangle maps were used for the initial ground control to set the interpretations in the state plane coordinate system. The absolute accuracy is $\pm$50' and the relative accuracy is $\pm$10'. The shoreline was interpreted according to the location of the wet/dry beach contact visible on aerial photographs, the outer edge of well-established marsh, or the outer edge of organic beaches. The work product is a map showing the location of the habitat types in each area.

4) Habitat Classification

The habitats are interpreted from the photography by discernible and recognizable differences in infrared color and texture, and specific areas were then ground truthed in the field for positive habitat identification and vegetative community composition.

The habitats will be broken into simple classes and sub-classes: water, wetlands (marsh and swamp), and land (beach, bare, dune, upland, shrub/scrub, and forest). These very general characterizations necessarily incorporate many other habitats and transition areas.

There are many areas that cannot easily be separated into one of these categories. The establishment of vegetation is a succession of gradual transitions as plant communities colonize, compete, adapt or die, and eventually dominate each habitat. Difficulties arise as an interpreter attempts to classify areas that are in transition from one class to another, either temporally, such as marsh newly colonizing a submerged area, or spatially, marsh grading to upland. At some point along the gradual and subtle changes in elevation, vegetative density, or vegetative composition, an interpreter must make a decision and draw a line, attempting to be consistent each time.

The habitat categories used are italicized below and were delineated using the definitions and criteria defined below.

Water (not included in statistics)

Open water is water not completely encircled by land, including some intertidal areas.

Intertidal is an indistinct, shallow area that indicates natural sediment deposits or dredge material deposits below normal high tide that does not support emergent vegetation. Some of these areas do support submerged aquatic vegetation or can become colonized by marsh vegetation.

Wetlands

Marsh for our purpose, is any unforested, vegetated area normally subject to inundation or tidal action at any time, sufficient to support wetland-dependant, emergent vegetation. The type of marsh is further broken into classifications based on the salinity regime of the area which is indicated by the dominant vegetation in Louisiana. *High marsh*, an area above normal high tides but inundated frequently by spring and storm tides or seasonally heavy rainfall can occur in conjunction with any type of marsh, but is associated most commonly along the coast with saline marshes and is dominated there by Spartina patens and Distichlis spicata. High marsh associated with fresh or brackish marsh is often represented by grasslands and considered uplands.

Saltmarsh, high salinity (20-40 parts per thousand), is dominated by Spartina alterniflora, Juncus roemerianus, and Distichlis spicata.

Brackish marsh, moderate salinity (0.5-16 parts per thousand), is dominated by Spartina patens and Distichlis spicata.

Intermediate marsh, low salinity (0.5-8 parts per thousand), is dominated by Spartina patens, Phragmites australis, Echinochloa walterii, or Scirpus sp.).

Freshmarsh, no salinity (less than 0.5 parts per thousand), is dominated by Sagittaria spp. and Panicum hemitomon.

Forested Wetlands is any forested area normally subject to inundation through part of the growing season, or with permanent or near-permanent standing water. This includes swamps, batture communities, bottomland forest, and riparian forest. Dominant tree species indicate more specific habitats; in the study area usually:

Cypress swamp, dominated by Taxodium distichum.

Willow swamp or *batture community*, dominated by Salix nigra. A batture community colonizes open areas along waterways, or on newly deposited or newly exposed areas near water.

Land

Beach is an unvegetated area adjacent to open water that is subject to direct wave action at some time during the daily tidal cycle or during average storm surges. This can be sand, shell, organic, or a mixture of sediment types. This area is unlikely to permanently support vegetation because of frequent reworking by wave action. Most colonization occurs on the upper beach area less frequently affected by waves.

Dune is an area above the high water line formed by aeolian deposition of sand into ridges or hummocks.

Bare land encompasses the areas that are unvegetated and not normally subject to direct wave action. It may be adjacent to open water but in a more sheltered orientation not subject to active wave reworking. Usually it indicates areas of fresh, deposited dredged material or recent natural sediment deposition. It may include areas of sparse plant colonizations that may become either upland or marsh.

Upland is a natural area or dredged material deposition area that is elevated and not subject to tidal action or inundation under normal circumstances so that upland species (non-marsh species) thrive. For this study, it includes barrier island habitats as well as inland habitats, does not include significant shrub or tree coverage, and usually denotes a grassland, meadow, or some types of agricultural land. Natural succession may lead to shrub/scrub in some areas.

Shrub/scrub is an area dominated by shrubs or small trees under 20 feet tall. This may be within an upland area or within a marsh area. Within a marsh, shrubs usually occupy elevated areas, marking natural levees or areas artificially elevated. Natural succession may eventually lead to forest or forested swamp in some areas.

Forest is any area dominated by trees, that is not normally subject to inundation during the growing season or is only periodically influenced by flooding. For this study it includes bottomland hardwood areas as well as oak or pine woods.

5) Groundtruthing

The interpretations of habitat type are verified by taking the photography or interpreted map into the field to check against the actual landscape. Corrections are made where necessary to the map, and the revised map is then submitted for GIS digitization and final analysis. For each monitoring site, a base year was selected upon which the assessment of changes are based. The dates of the base years are listed in Table 2. The base year photography is acquired from sources such as National Aeronautics and Space Administration, U.S. Department of Agriculture, U.S. Geological Survey, USACE,and the U.S. Fish and Wildlife Service.

Field Program

The field program supported the air photo-interpretation and GIS analysis tasks. The field program was comprised of two work efforts. The first field effort, groundtruthing, verified the interpretation of habitat type, vegetative cover, and surface morphology from the aerial photographic analysis. The second field effort, field monitoring, recorded changes in elevation, vegetative cover, geomorphic character, and surface texture at selected beneficial use sites in order to assess the best disposal practices.

1) Ground Truthing

The interpretation of habitat type and vegetative cover within each beneficial use site were made from the color infrared aerial photography. These interpretations were made remotely by trained photo-interpreters. The work product is a map showing the location of the habitat types in each area. These interpretations were confirmed by site visits to each beneficial use disposal area. The photo-interpreted map was taken into the field and checked against the disposal area landscape. Corrections were made where necessary to the habitat map, and the revised map was then submitted for GIS data development and final analyses.

2) Field Monitoring

The objective of the field monitoring is to clarify the habitat types by identifying dominant vegetative communities, and to determine the best disposal elevation and placement configuration in order to produce the maximum habitat benefits. Monitoring changes in elevation, habitat type and surface morphology at a disposal site will identify the important processes that control change. Understanding the relationships between change and process and habitat and elevation will facilitate better predictions of the potential habitat benefits associated with different placement elevations and configurations.

Permanent benchmarks placed by the USACE-NOD or USACE-NOD contractors and temporary benchmarks placed on site by LSU to mark study profiles were established within each beneficial use dredged material disposal site to provide monitoring baseline. The elevation of these benchmarks was determined using either an existing datum, tide gage data combined with shoreline morphology, or a global positioning system (GPS). Where existing datums occur within range to the disposal site, a laser driven Total Station survey instrument will be used to level between the known datum and the new benchmark. This will allow the direct establishment of the elevation at the new benchmark.

Where there is no existing datum to use, an elevation can be inferred from tide gage data or measured directly by a GPS system. The inferred method uses a tide gage in close proximity to the site as a calibration for elevation. During the establishment of the benchmark, a measurement between the water level and the benchmark elevation was made. The tide gage record is then reviewed to determine the water level elevation at that moment in time. The elevational difference between the measured water level and benchmark height was then correlated back to the known datum for the tide gage to determine the actual benchmark elevation. This position was then referenced to the morphology of the high tide position on the shoreline. A direct measurement of the elevation of the new benchmark was also made using a global positioning system (GPS) survey system. Depending on the number of satellites available, two or three benchmarks was established per day. The new benchmarks were then used to survey other ones in close proximity.

Once the benchmark was established, a transect was surveyed to record elevation, habitat types, and vegetative cover for that beneficial use site. This data was compared to original dredge material stacking height information where available for initial performance evaluation of the newly created areas. Seasonal monitoring of this transect will record changes in elevation, habitat type, vegetative cover, and surface morphology. With repeated surveys, changes along the transect can be determined and interpreted. This information leads to an understanding of the relationship between disposal elevation and placement configuration in producing the maximum habitat benefits.

Geographic Information System (GIS) Analysis

Once the photography was acquired and interpreted for each site, the digital files were imported into the GIS, ground truthed, and referenced to its true geographic position. The line work was checked for gaps, overshoots and other digitizer errors and edited accordingly. A project schema was created to organize data attributes: area, habitat type, and perimeter. After corrected digital data sets were generated for each USACE-NOD beneficial placement site, two primary forms of GIS analysis were used to quantify and characterize wetland conditions at selected sites. The first form of analysis was the extraction of area measures for each habitat type. Values were generated per type for each year and location. The second form of GIS analysis was the creation of change detection maps and tables for interim periods. These illustrated primary trends in geomorphic change by comparing shoreline configurations and total areas of habitat for the different time periods.

World Wide Web Site

To facilitate the transfer of information to the natural resource trustees and other interested parties, LSU proposes to develop a World Wide Web site for the dissemination of the beneficial use of dredged material monitoring data. A home page will be developed that will allow the user to click (hyperlink) through data on the beneficial use of dredged material. The user will be able to view scanned aerial photographic mosaics, habitat maps, habitat change maps, habitat data spread sheets, and the results of field investigations. The web site will be updated periodically and for the annual dredging conference.

WORK PRODUCTS

The work products for 1996 are 1) vertical, color, aerial photography, 2) color photo mosaics for October/November 1995 and color digital mosaics for November 1996, 3) habitat inventory maps, 4) shoreline change maps, 5) habitat change maps 6) change data matrices, 7) dredged material disposal history map 8) habitat creation and configuration monitoring results, 9) Coordination, 10) annual report, 11) BUMP archive, and 12) World Wide Web site.

1) Aerial Photography
   Color infrared aerial photography was acquired for areas selected by the USACE-NOD along each navigation channel (Appendix A). The scale of the photography was 1:24,000 in a 9" X 9" format.

2) Photo Mosaics
   For all of the beneficial use of dredged material areas delineated in Appendix A, a color infrared, aerial photographic mosaic was produced: photographically for the October/November 1995 photography and digitally for the November 1996 photography. The scale was approximately 1:24,000 within a 36" width.

3) Habitat Inventory Maps
   Habitat inventory maps were produced from the aerial photographic analysis for selected beneficial use areas on each navigation channel, for the base year and the selected monitoring years. Areas that could be determined to be created by BUMP were delineated. Habitat maps were produced at a scale to show appropriate resolution.

4) Shoreline Change Maps
   Shoreline change maps were produced where appropriate to show general trends in erosion and accretion of the study area.

5) Habitat Change Maps
   Habitat change maps were produced from the GIS analysis comparing the base year photography with subsequent monitoring year photography. These maps depict how the habitat evolved and changed through time to highlight areas created by BUMP. These maps were produced at the same scale and format as the habitat maps.

6) Change Data Matrices
   The data generated by the aerial photographic and GIS analyses was organized into data matrices for easy review and interpretation. Starting with the base year, information was generated to quantify, in acres, the amount of new wetlands and other habitats created. From the change analysis, data on how the habitats changed between each time period is provided. Sites previously monitored were updated.

7) Dredged Material Disposal History Map
From "As-Builts" provided by the USACE-NOD, historical photography and maps and any other information available, LSU compiled data into a map to illustrate the dredged materials placement history within the study area. This is only as accurate as the information that was located. This map is provided as a figure within the monitoring report.

8) Habitat Creation and Configuration Monitoring Results
For the beneficial use sites chosen, the results of the aerial photographic and GIS analysis combined with the field monitoring results document the performance of different disposal elevations and configurations to create wetlands and other valuable habitats. Using this new information, the USACE-NOD in cooperation with natural resource agencies can formulate new plans to improve disposal methods for the beneficial use of dredged material.

9) Coordination
LSU coordinated with USACE-NOD on a regular basis, participated in meetings with project engineers and natural resource agencies, and will present monitoring data at technical meeting and workshops. Semi-annual reports or memos were provided to document project milestones. Monthly work plans were developed with the USACE-NOD to coordinate changes in the LSU monitoring program in response to changes in USACE-NOD dredging activities, and to track monitoring program performances.

10) Annual Report
This is the annual report for the USACE-NOD Annual Dredging Conferences that has been prepared for distribution to the attendees. The annual report summarizes the status of sites being monitored for habitat inventories, wetland change statistics, recommendations concerning stacking elevations and placement configurations, and the total wetland and other habitat acreage created to date in the USACE-NOD.

11) BUMP Archive and LSU Facilities
LSU has established a data archive within the Howe-Russell Geoscience Complex for the USACE-NOD beneficial use of dredged materials monitoring program. Aerial photography, project mosaics, habitat maps, habitat change maps, and all digital data is being stored and maintained on the LSU campus. The archive contains two dedicated GIS workstations for viewing and analyzing wetland creation data. The archive also contains the data and results of the field monitoring program.

12) World Wide Web Site
LSU has established a World Wide Web Site for the distribution of BUMP data sets to natural resource trustees and other interested parties. The web site will be updated periodically as information is available. The BUMP Homepage may be accessed at http://beach.csi.lsu.edu/bump/

SUMMARY

The U.S. Army Corps of Engineers - New Orleans District in cooperation with Louisiana State University - Coastal Studies Institute established the Beneficial Use Monitoring Program (BUMP) to document the creation of new land through the placement of dredge material. The methodology used to quantify the creation or enhancement of new coastal lands through the beneficial use of dredge material is listed below.

1. Annual acquisition of color infrared photography of the eleven monitoring sites.

2. Creation of air photo mosaics of each monitoring site.

3. Photo-interpret the shoreline and habitat environments for each site and convert to digital data.

4. Import the digital shoreline and habitat data into Intergraph MGE for analysis.

5. Use Intergraph MGE to inventory each monitoring site for each time period and perform change detection analysis for each time period pairs.

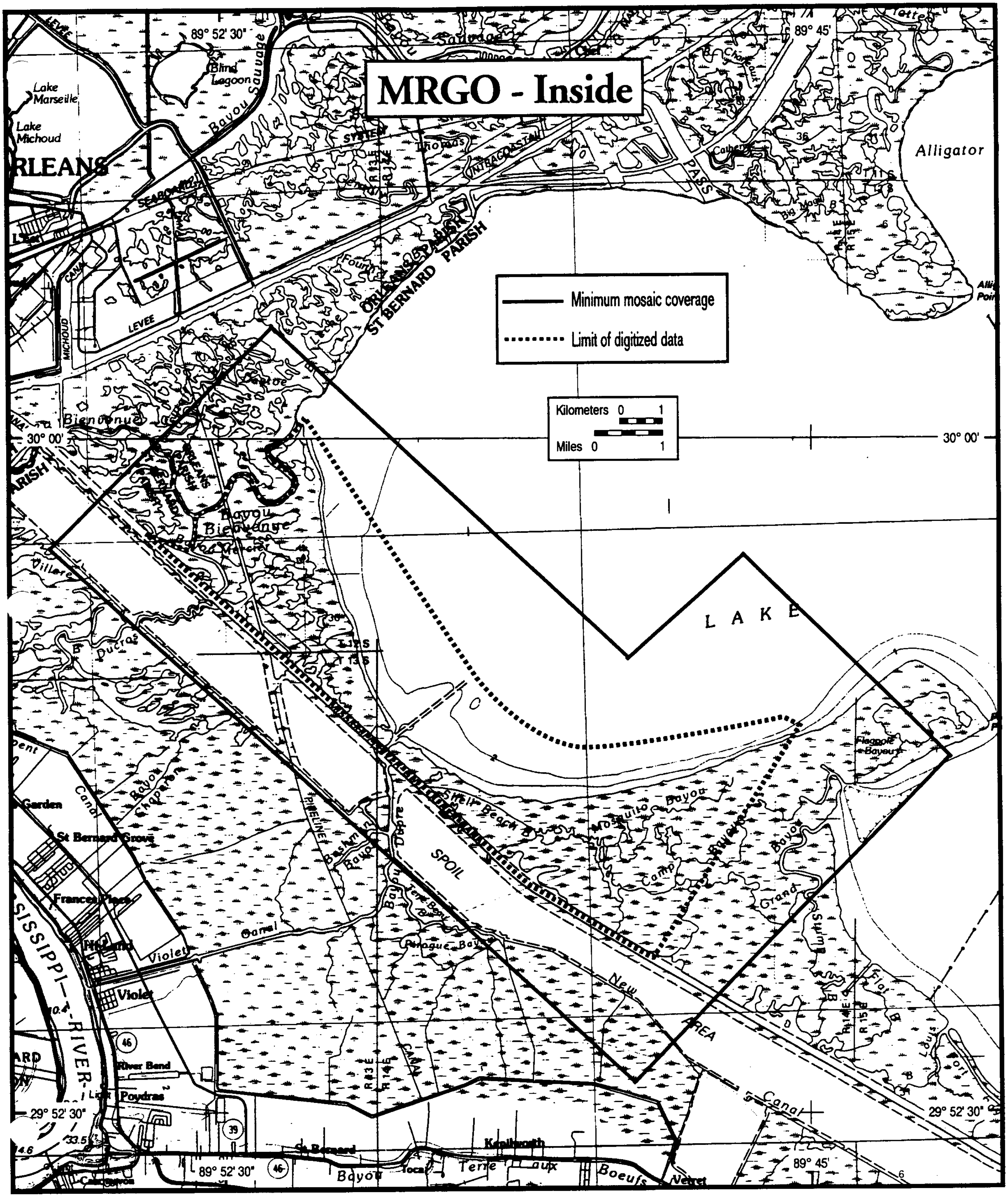
6. Ground truth the Intergraph MGE results.

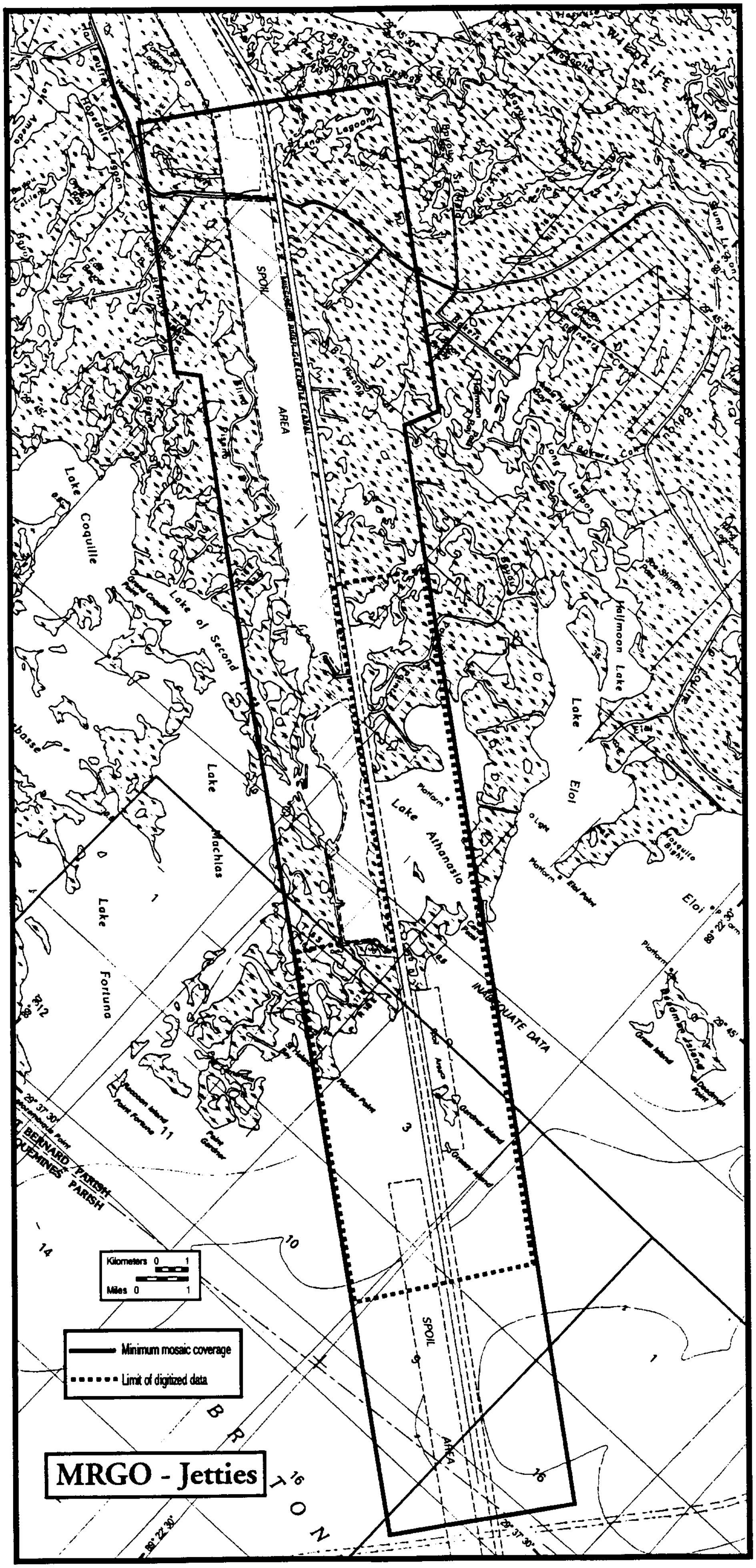
7. Conduct field monitoring to determine the best stacking height and placement configuration strategies for each site.

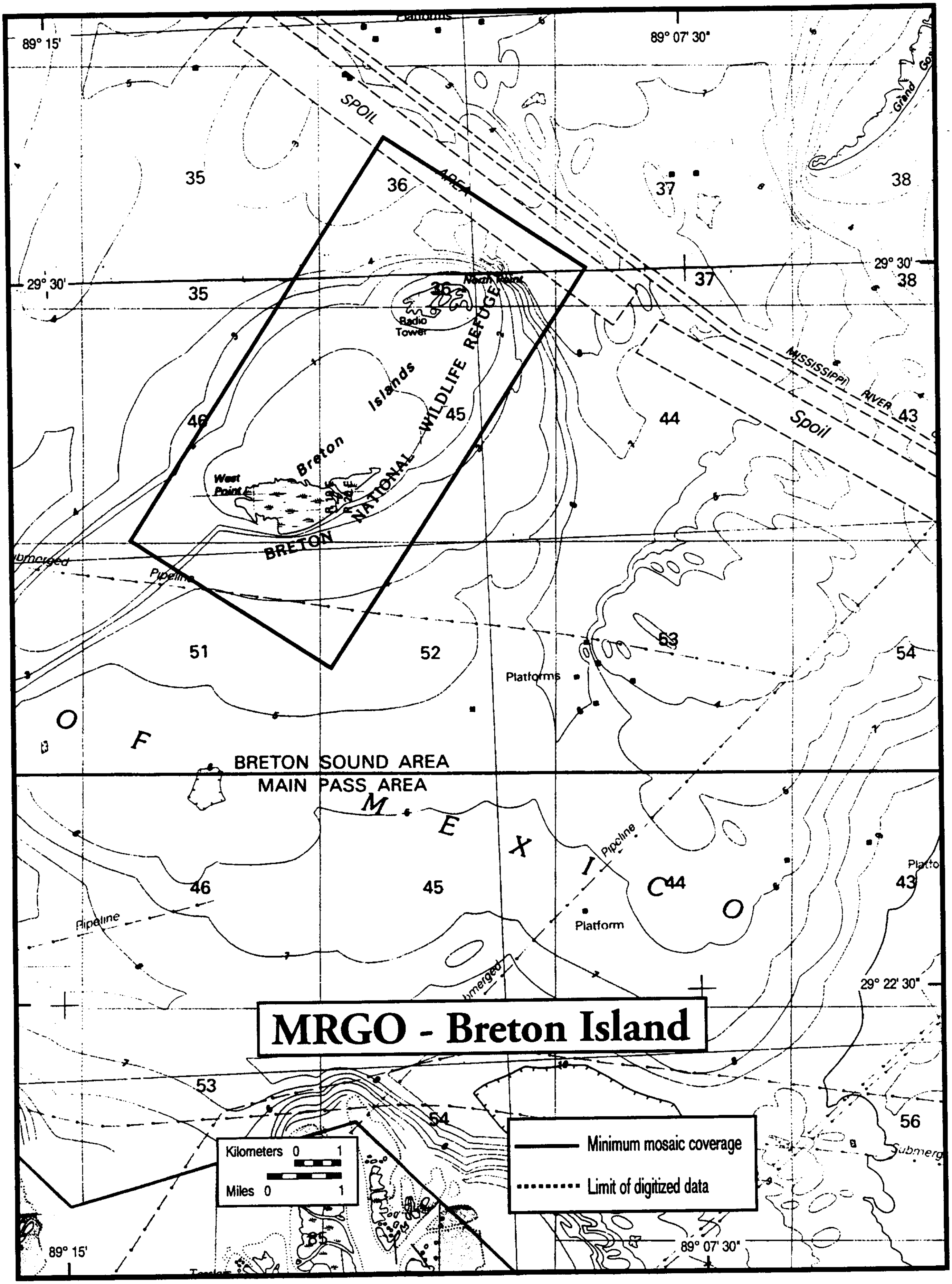
REFERENCES

Wayne, L.D., Penland, S., Westphal, K.A., Hiland, M.W., Connor, P., and Zganjar, C.E., 1995. Development of a coastal monitoring program to document the beneficial use of navigation dredge materials in the U.S. Army Corps of Engineers - New Orleans District: Baptiste Collette Bayou Pilot Study. U.S Army Corps of Engineers, 34 pp.

APPENDIX 1A: BASE MAPS

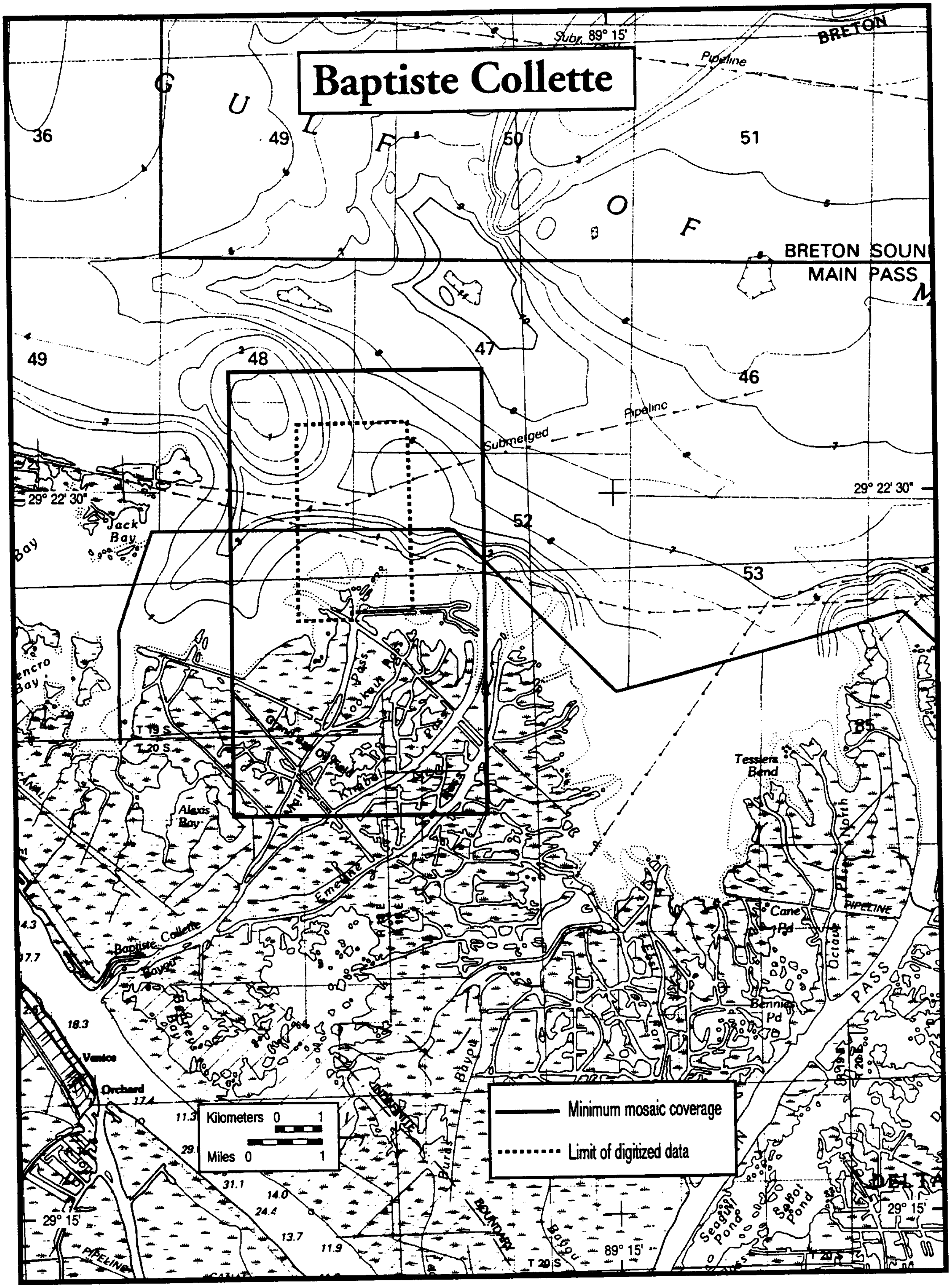

MRGO - Inside
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
89° 52' 30"
89° 45'
30° 00'
29° 52' 30"
Alligator
LAKE
SPOIL
ORLEANS PARISH
ST BERNARD PARISH
Bayou Sauvage
Blind Lagoon
Lake Marseille
Lake Michoud
Bayou Bienvenue
Bayou Dupre
Shell Beach
Mosquito Bayou
Flagpole Bayou
St Bernard Grove
Frances Place
Violet
River Bend
Poydras
St Bernard
Kenilworth
Bayou Terre aux Boeufs
Verret
New Canal

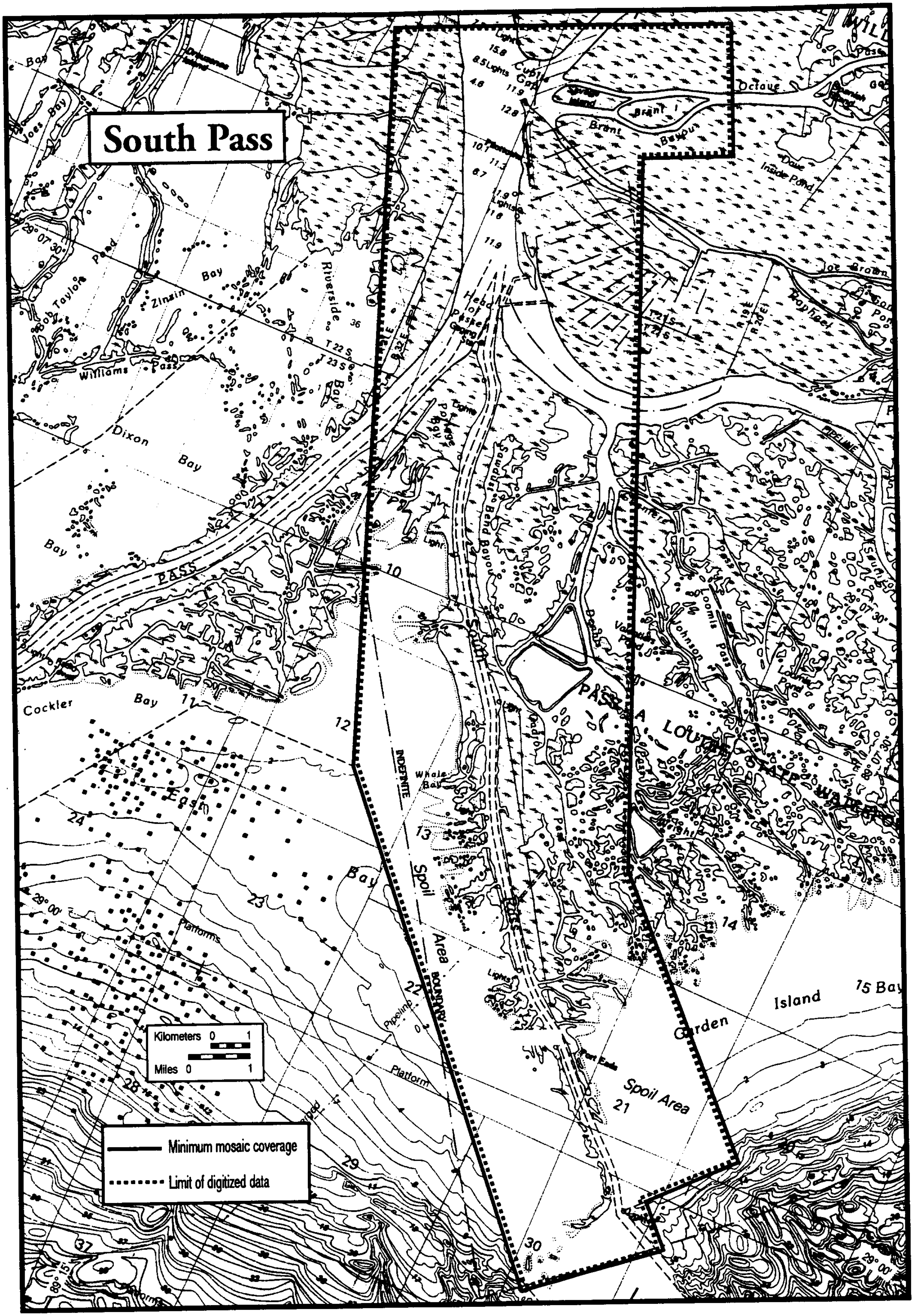

MRGO - Jetties
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
SPOIL
AREA
INADEQUATE DATA
Lake Coquille
Lake of Second
Lake Machias
Lake Fortuna
Lake Athanasio
Lake Eloi
Halfmoon Lake
ST. BERNARD PARISH
PLAQUEMINES PARISH
BRETON

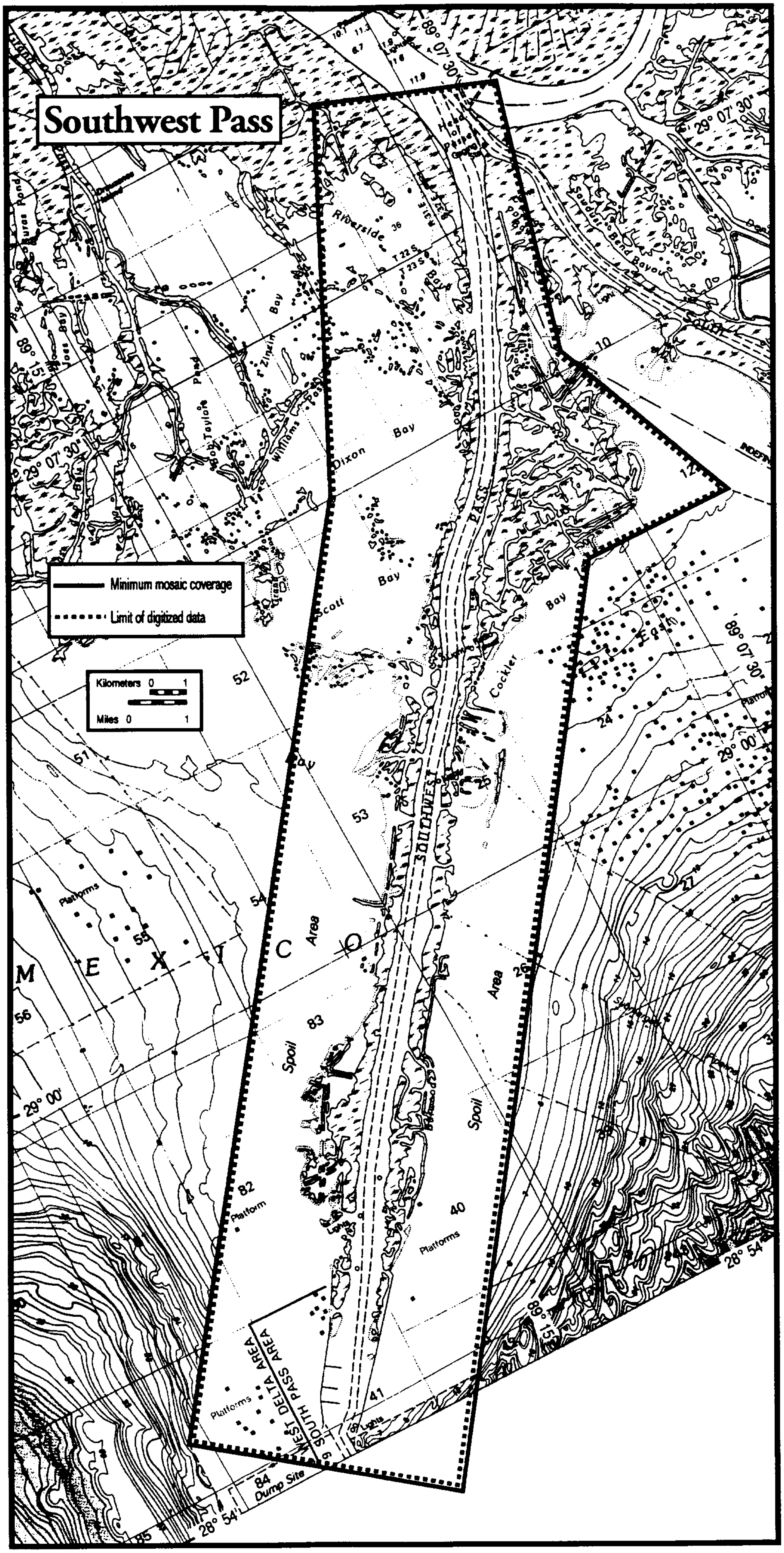


MRGO - Breton Island
89° 15'
89° 07' 30"
29° 30'
29° 22' 30"
SPOIL AREA
Spoil
MISSISSIPPI RIVER
Breton Islands
BRETON NATIONAL WILDLIFE REFUGE
North Point
Radio Tower
West Point
BRETON SOUND AREA
MAIN PASS AREA
O F M E X I C O
Platforms
Platform
Pipeline
Submerged
35
36
37
38
46
45
44
43
51
52
53
54
56
Kilometers 0 1
Miles 0 1
Minimum mosaic coverage
Limit of digitized data

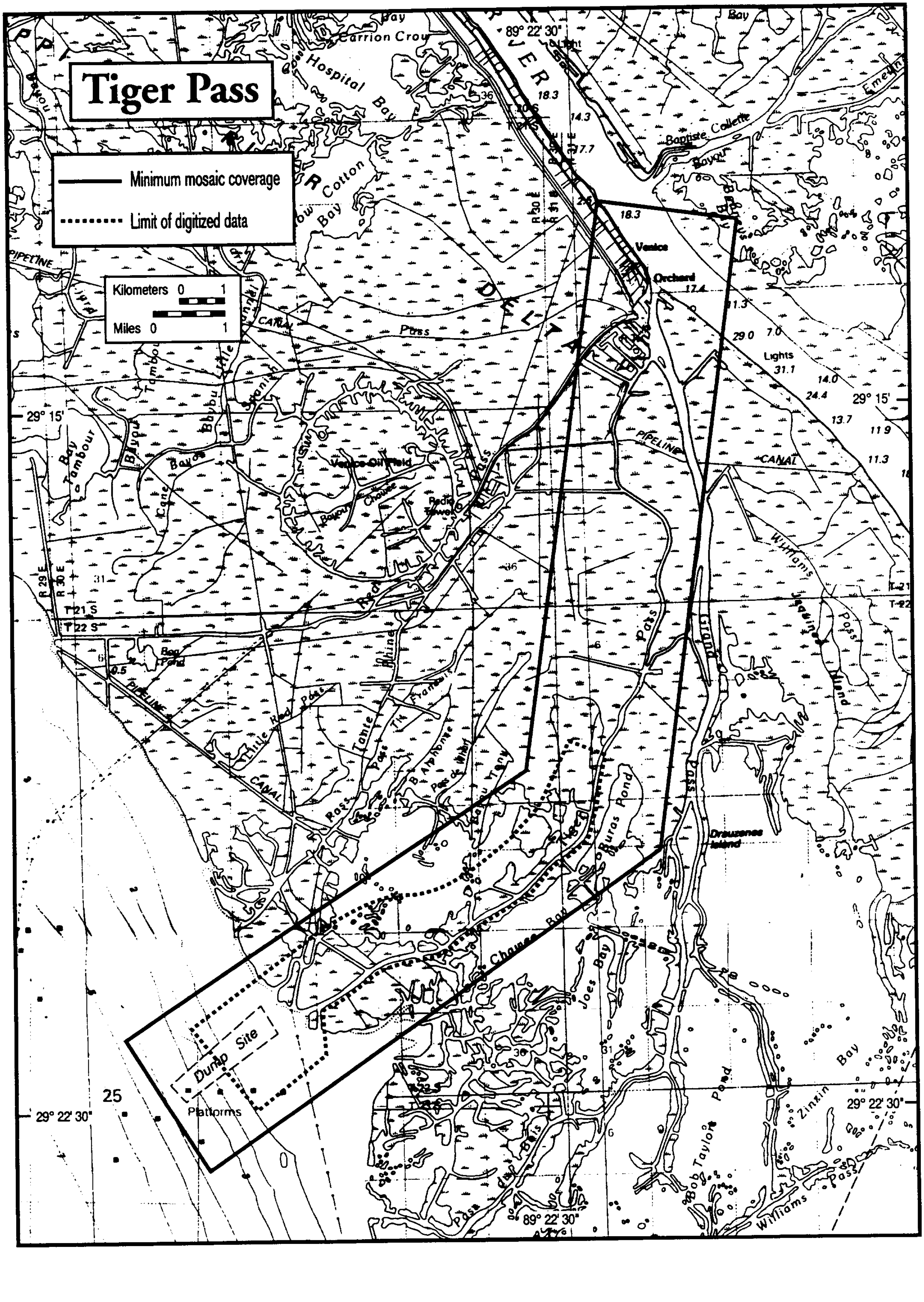
Baptiste Collette

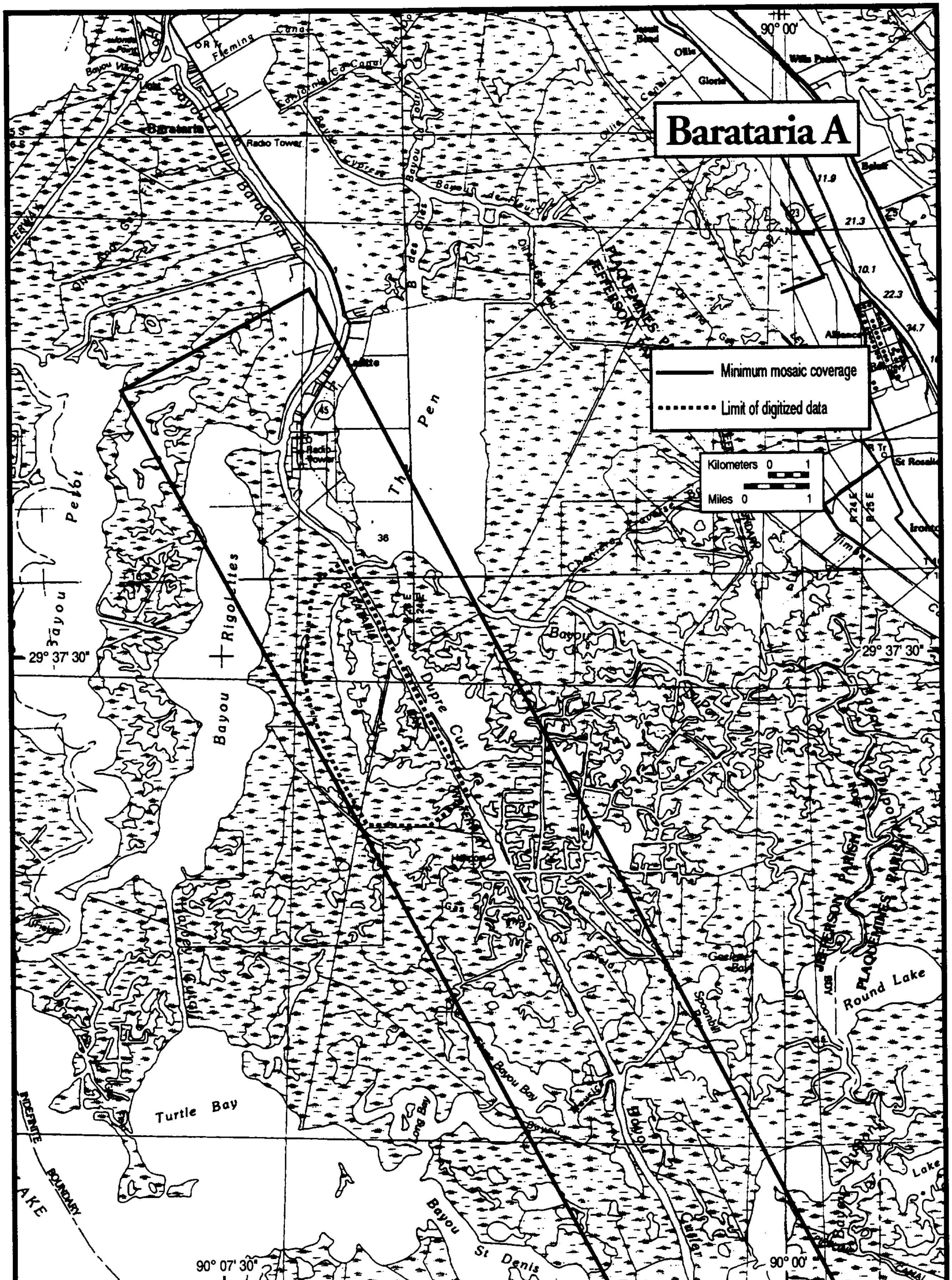


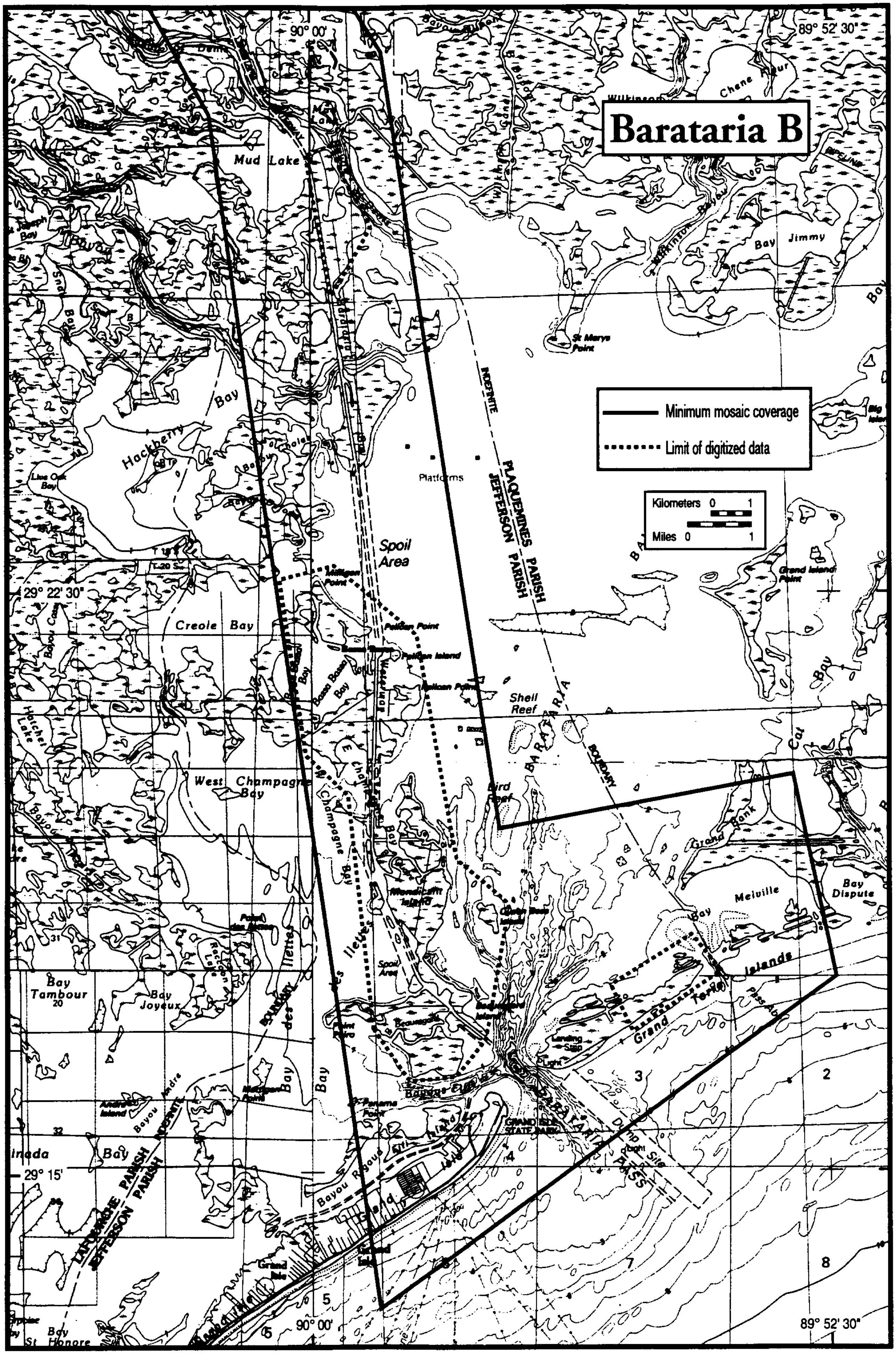

South Pass
Kilometers 0 1
Miles 0 1
Minimum mosaic coverage
Limit of digitized data
Dixon Bay
Cockler Bay
Zinzin Bay
Riverside Bay
Williams Pass
Bob Taylors Pond
Joes Bay
Octave
Brant Bayou
Inside Pond
Joe Brown
Raphael Pond
Head of Passes
Pass
South Pass
Sawdust Bend Bayou
Johnson
Loomis Pass
Pass a Loutre State Waterfowl
Whale Bay
East Bay
Spoil Area
Platforms
Pipeline
Platform
Garden Island Bay
Port Eads
Spoil Area
T 22 S
T 23 S
29° 07' 30"
29° 00'
89° 07' 30"
89° 15'



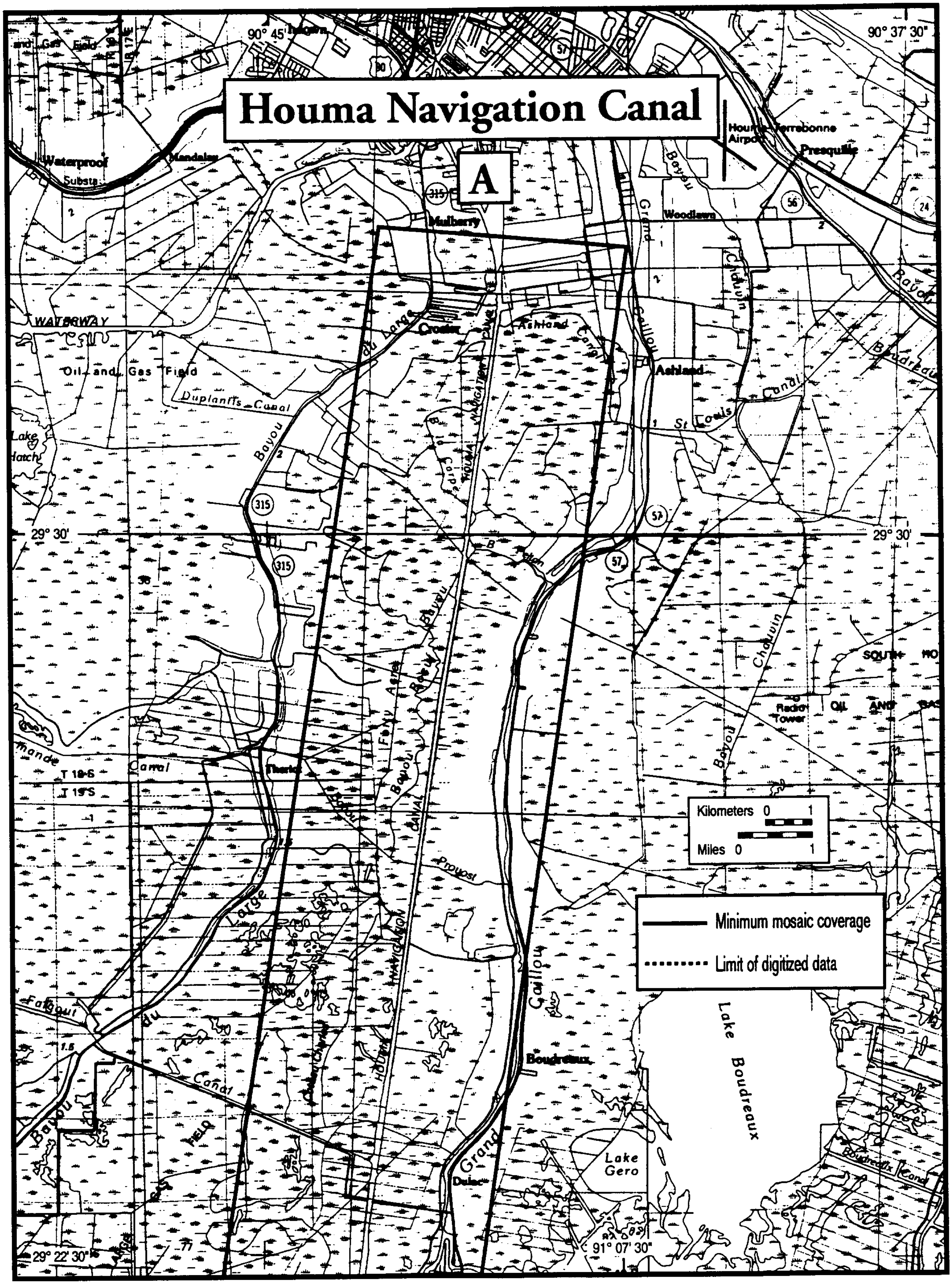
Southwest Pass
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
SOUTHWEST PASS
Riverside Bay
Dixon Bay
Scott Bay
Cockler Bay
Spoil Area
M E X I C O
Platforms
SOUTH PASS AREA
WEST DELTA AREA
Dump Site
29° 07' 30"
29° 00'
28° 54'
89° 07' 30"
89° 15'


Tiger Pass
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
89° 22' 30"
29° 15'
29° 22' 30"
Carrion Crow
Hospital Bay
Cotton Bay
Baptiste Collette
Bayou
Venice
Orchard
Lights
PIPELINE
CANAL
Pass
Venice Oil Field
Bayou Chouee
Radio Tower
Bayou Tambour
Bay Tambour
Cane Bayou
Spanish Pass
Little Tambour
Red Pass
Little Red Pass
Bay Pond
Tante Phine Pass
Bayou Tony
B Alphonse
Pass de Wharf
Ross Pass
Buras Pond
Grand Pass
Drouzenee Island
Jacques Island Pass
Williams Pass
Chenier Bay
Joes Bay
Dump Site
Platforms
Bob Taylors Pond
Zinzin Bay
Pass de Bois
R 29 E
R 30 E
R 31 E
T 20 S
T 21 S
T 22 S
25

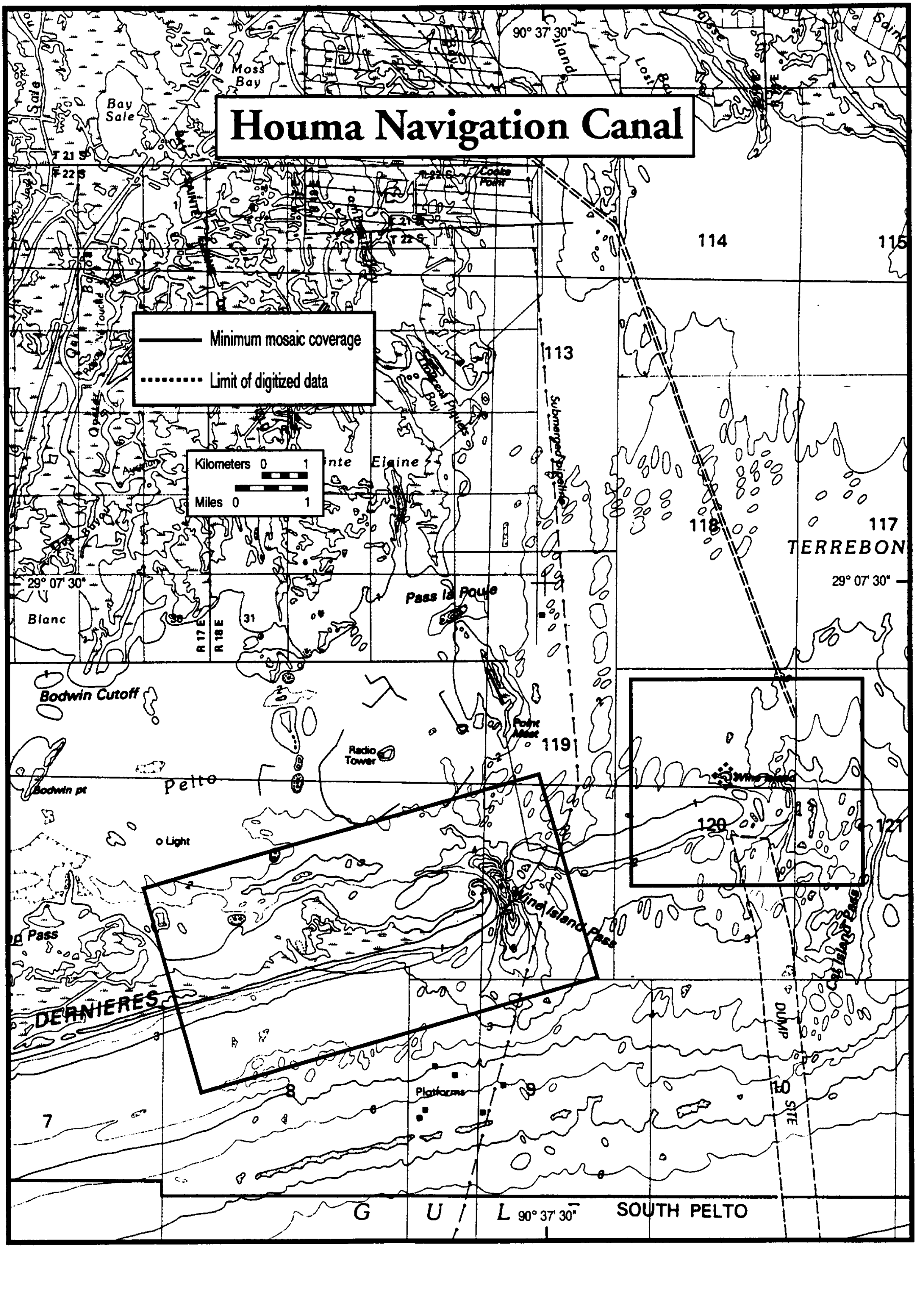

Barataria A
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
29° 37' 30"
29° 37' 30"
90° 00'
90° 07' 30"
90° 00'
Barataria
Radio Tower
Lafitte
Bayou Barataria
Bayou Rigolettes
Bayou Perot
The Pen
Dupre Cut
Turtle Bay
Round Lake
Bayou St Denis
Bayou Villars
Fleming Canal
California Canal
Bayou des Oies
Bayou des Fleurs
PLAQUEMINES PARISH
JEFFERSON PARISH
Ollis
Gloria
Willa Point
Alliance
St Rosalie
Long Bay
Spoonbill
Bayou Bay
INDEFINITE BOUNDARY
LAKE



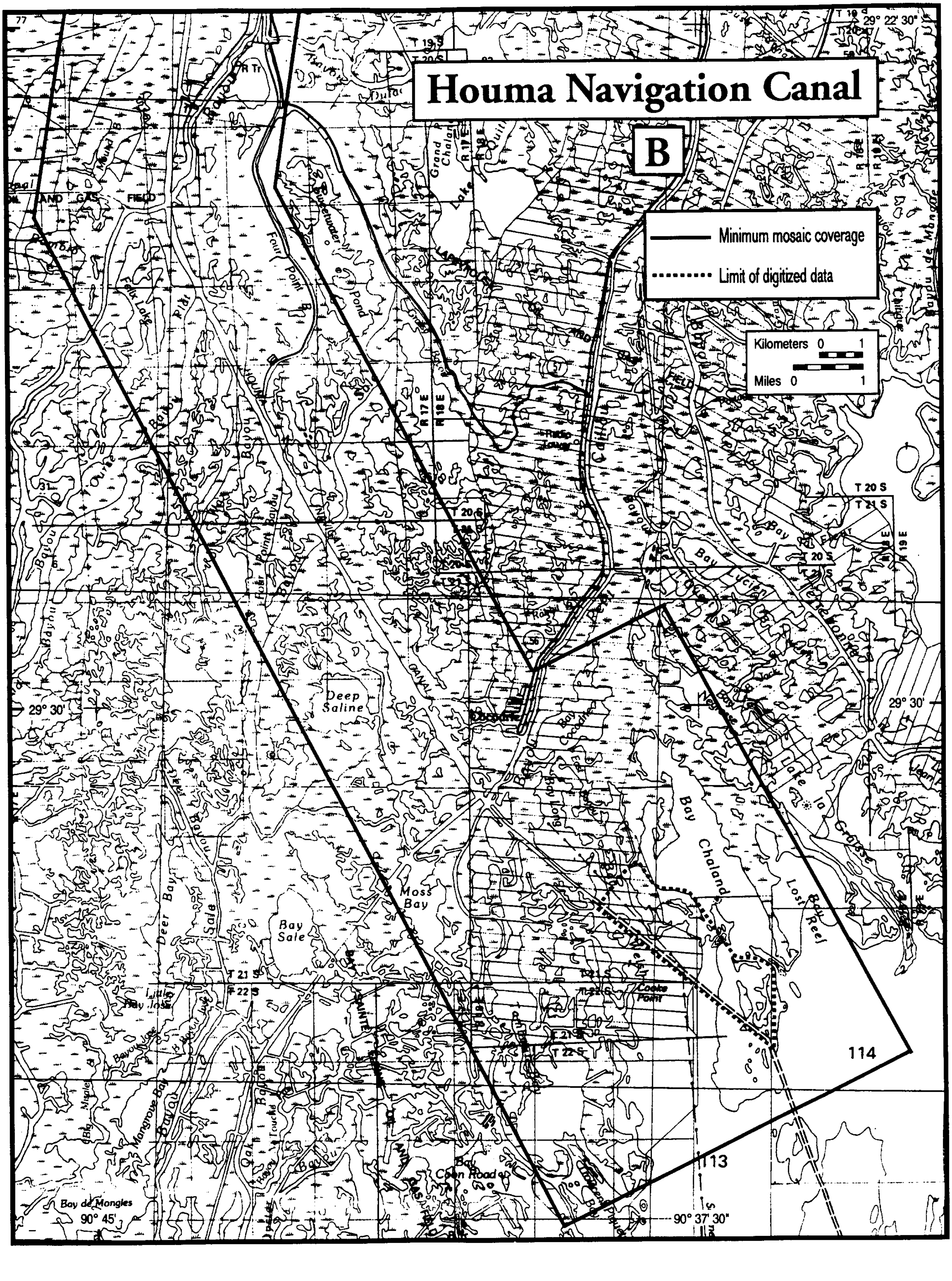
Barataria B
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
90° 00'
89° 52' 30"
29° 22' 30"
29° 15'
Mud Lake
Hackberry Bay
Creole Bay
West Champagne Bay
Bay Tambour
Bay Joyeux
Spoil Area
Platforms
PLAQUEMINES PARISH
JEFFERSON PARISH
LAFOURCHE PARISH
Shell Reef
Bird Reef
Bay Jimmy
Bay Melville
Bay Dispute
Grand Terre Islands
Grand Isle
GRAND ISLE STATE PARK
BARATARIA PASS
Bayou Rigaud
Bay St Honore



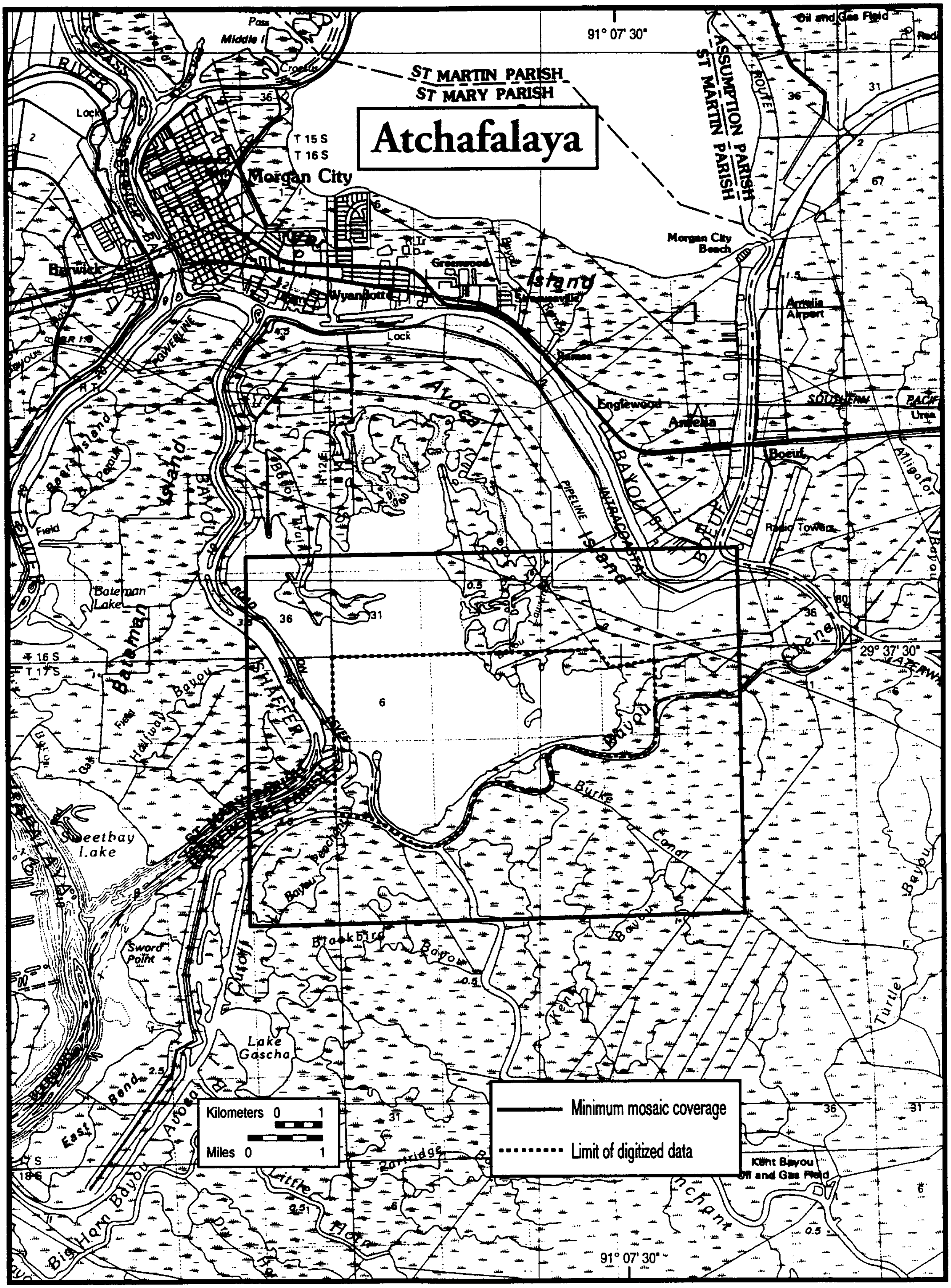
Houma Navigation Canal
A
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
90° 45'
90° 37' 30"
29° 30'
29° 30'
29° 22' 30"
91° 07' 30"
Waterproof
Mandalay
Mulberry
Crozier
Ashland
Woodlawn
Presquille
Houma-Terrebonne Airport
Bourg
Dulac
Boudreaux
WATERWAY
Oil and Gas Field
Duplantis Canal
Ashland Canal
St Louis Canal
Bayou Chauvin
Bayou Grand Caillou
Bayou du Large
Provost Canal
Falgout Canal
Lake Boudreaux
Lake Gero
Radio Tower
T 18 S
T 19 S
HOUMA NAVIGATION CANAL

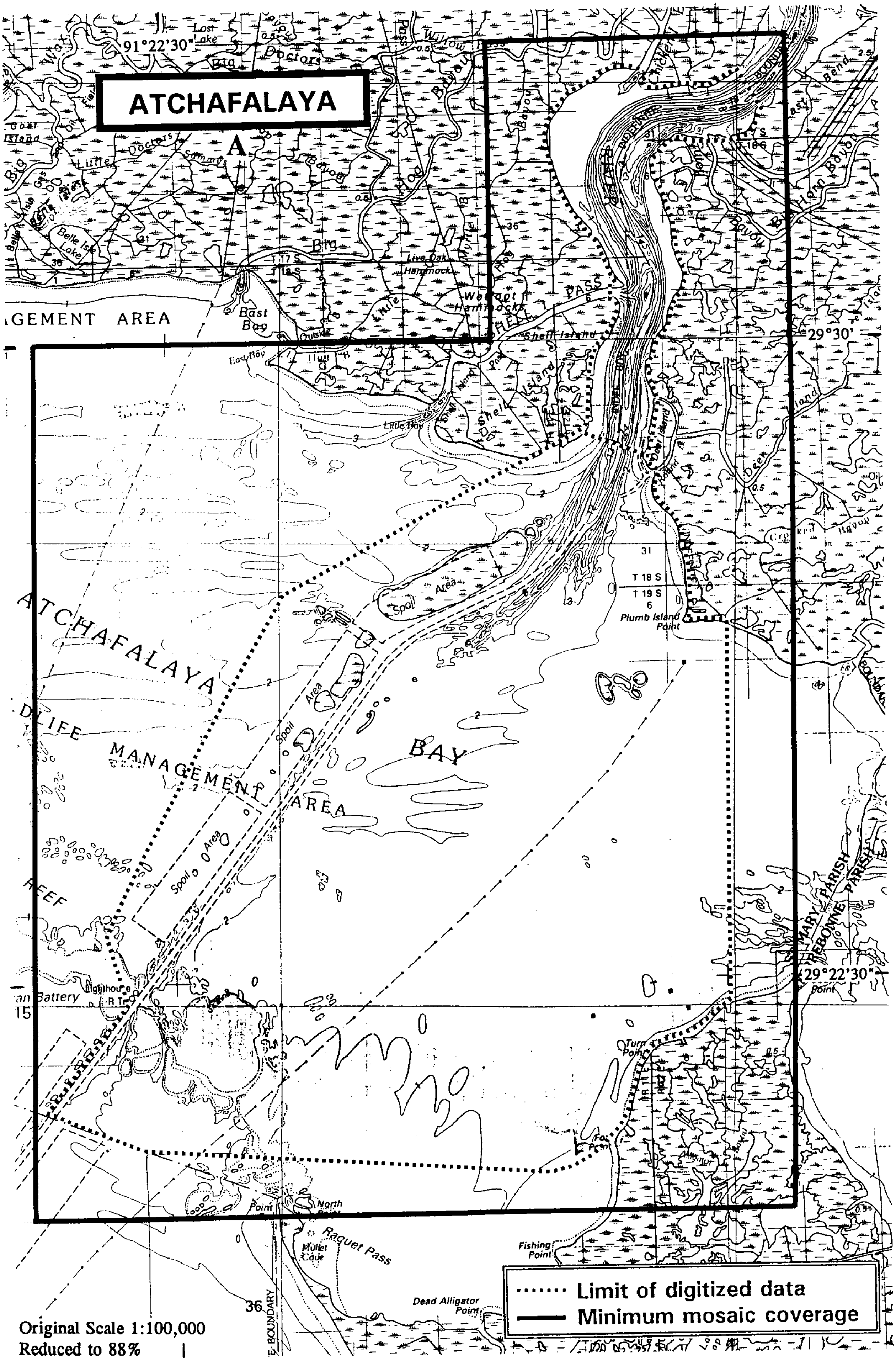


Houma Navigation Canal
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
Moss Bay
Bay Sale
90° 37' 30"
29° 07' 30"
114
115
113
118
117
TERREBON
119
120
121
Pass la Poule
Blanc
Bodwin Cutoff
Radio Tower
Pelto
Bodwin pt
Light
Wine Island Pass
Wine Island
Cat Island Pass
DERNIERES
Platforms
7
8
9
10
DUMP SITE
G U L
SOUTH PELTO

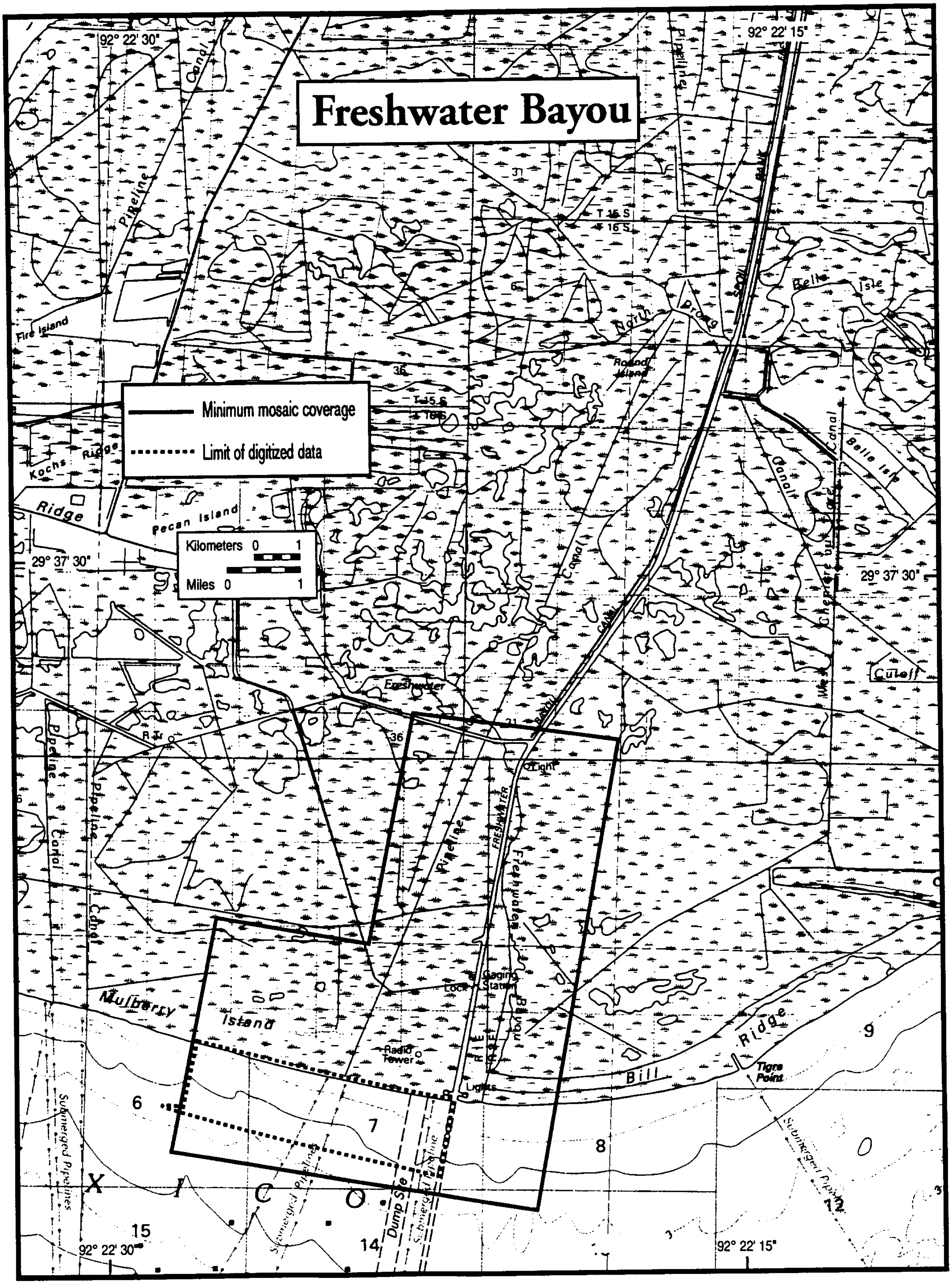


Houma Navigation Canal
B
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
29° 22' 30"
29° 30'
90° 45'
90° 37' 30"
Deep Saline
Moss Bay
Bay Sale
Bay Chaland
Lost Bay Reel
Lake la Graisse
Deer Bay
Bay de Mongles
Cocke Point
114
113
T 20 S
T 21 S
T 22 S
R 17 E
R 18 E
R 19 E

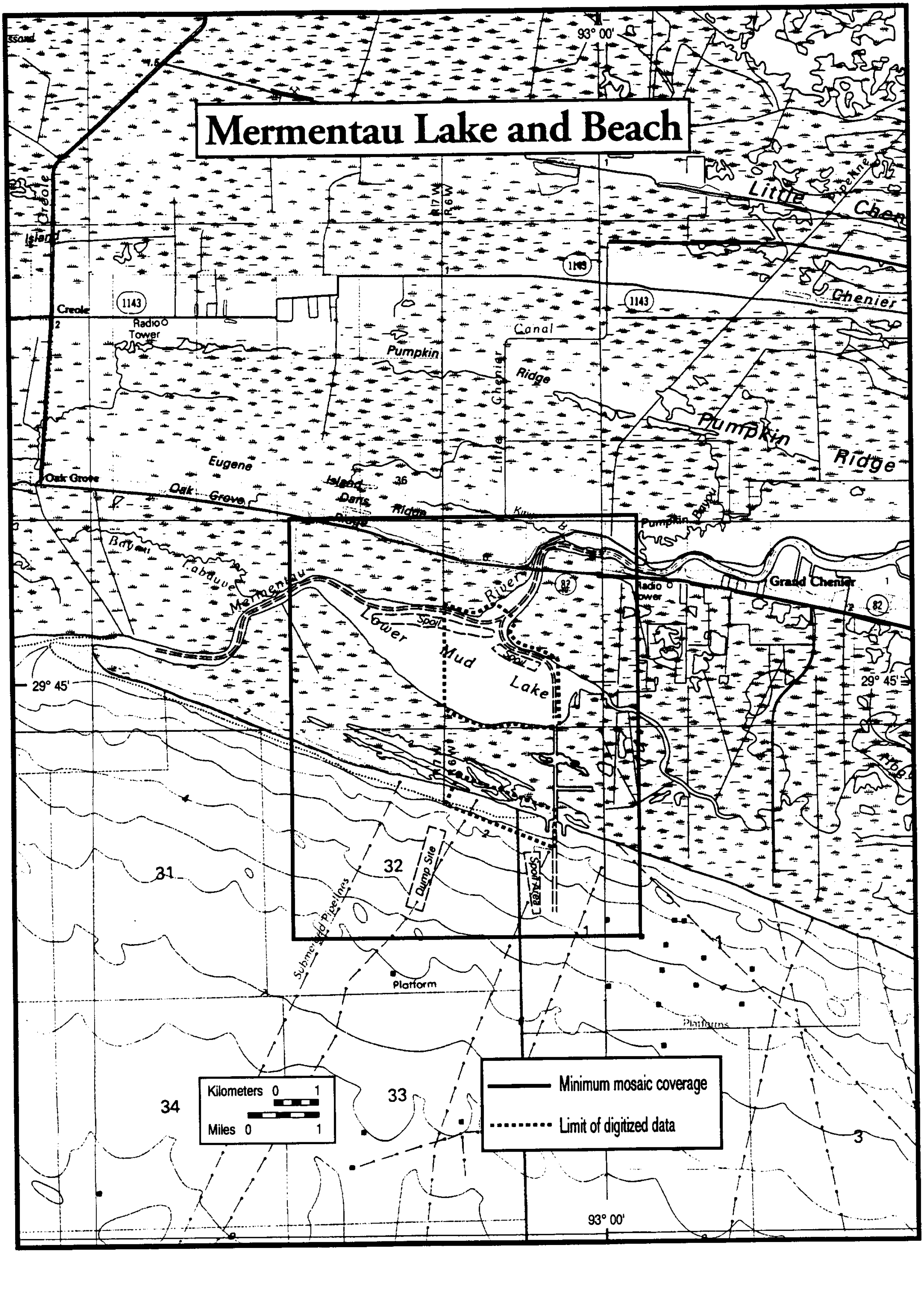

Atchafalaya
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
91° 07' 30"
29° 37' 30"
ST MARTIN PARISH
ST MARY PARISH
ASSUMPTION PARISH
ST MARTIN PARISH
Morgan City
Morgan City Beach
Berwick
Wyandotte
Greenwood
Amelia
Amelia Airport
Englewood
Boeuf
Radio Towers
Bateman Lake
Sweetbay Lake
Sword Point
Lake Gascha
Kent Bayou Oil and Gas Field
T 15 S
T 16 S
T 17 S

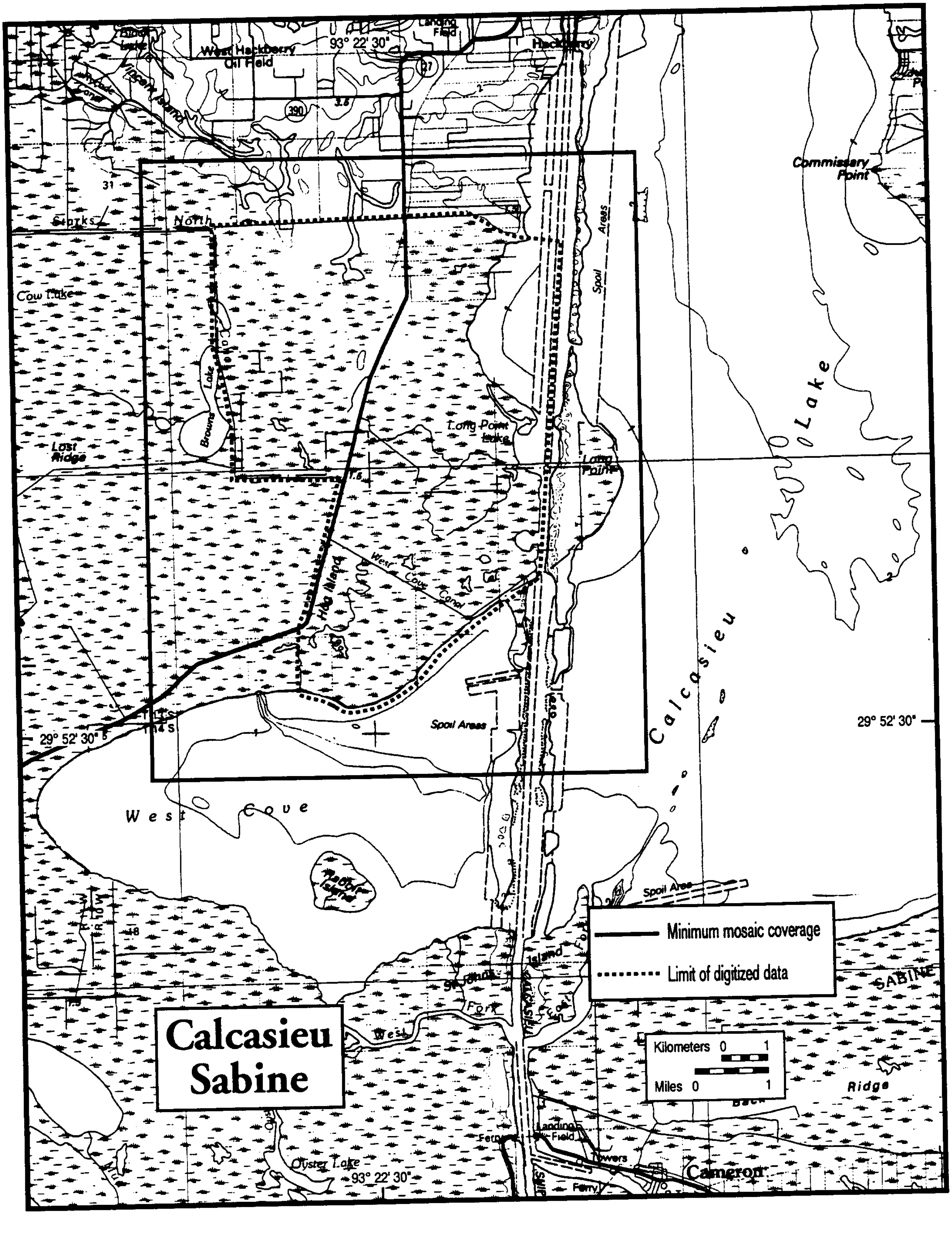


Original Scale 1:100,000
Reduced to 88%



Freshwater Bayou
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
92° 22' 30"
92° 22' 15"
29° 37' 30"
Pecan Island
Kochs Ridge
Ridge
Fire Island
Pipeline
Canal
North Prong
Belle Isle
Round Island
Belle Isle
West Chenier Cutoff
Cutoff
Freshwater
FRESHWATER
Freshwater Bayou
Pipeline Canal
Mulberry Island
Bill Ridge
Tigre Point
Gaging Station
Lock
Radio Tower
Lights
Light
Submerged Pipelines
Submerged Pipeline
Dump Site
T 15 S
T 16 S
6
7
8
9
12
14
15


Mermentau Lake and Beach
93° 00'
Little Chenier
Creole
Radio Tower
Pumpkin
Canal
Ridge
Pumpkin Ridge
Eugene
Oak Grove
Island
Mermentau River
Lower Mud Lake
Spoil
Grand Chenier
29° 45'
Dump Site
Spoil Area
32
31
33
34
Submerged Pipelines
Platform
Platforms
Kilometers 0 1
Miles 0 1
Minimum mosaic coverage
Limit of digitized data

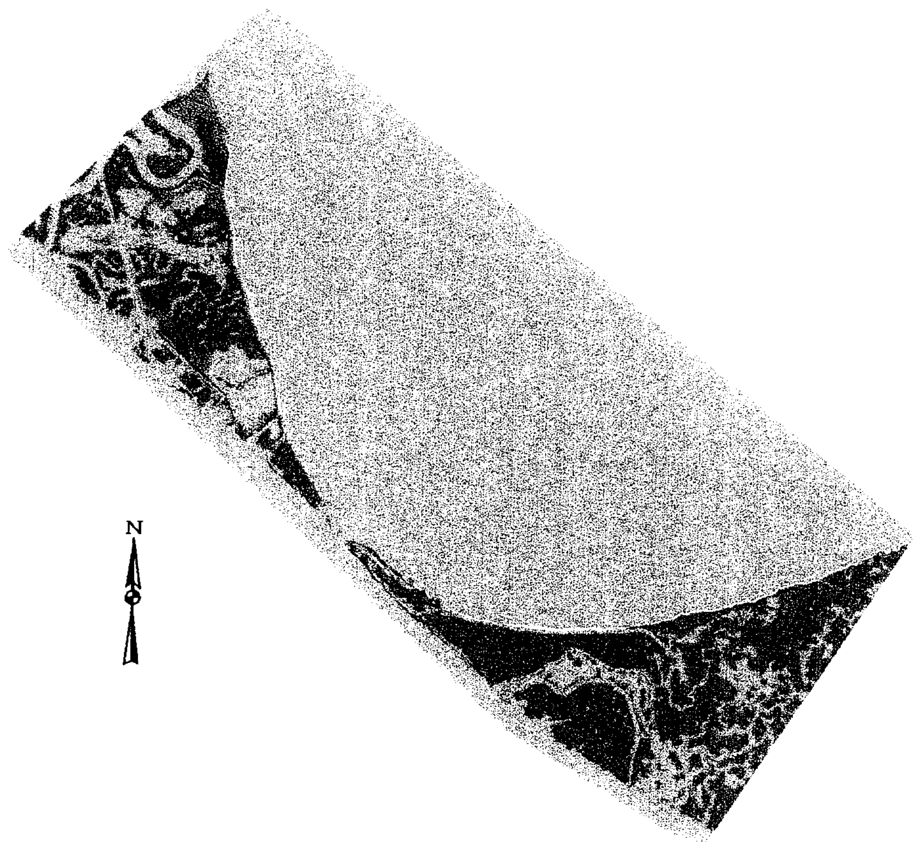

Calcasieu
Sabine
Minimum mosaic coverage
Limit of digitized data
Kilometers 0 1
Miles 0 1
93° 22' 30"
29° 52' 30"
West Hackberry
Oil Field
Hackberry
Landing
Field
Commissary
Point
Starks
North
Cow Lake
Browns Lake
Lost
Ridge
Long Point
Lake
Long
Point
Spoil
Areas
Spoil Areas
West Cove Canal
Hog Island
Calcasieu Lake
West Cove
Spoil Area
West
Fork
Ridge
SABINE
Oyster Lake
Ferry
Towers
Cameron

U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59

Base Year 1990 through Fiscal Year 1996



Shea Penland, Karen A. Westphal, Qiang Tao, Jamie Phillippe, Chris Zganjar and Paul Connor
Louisiana State University - Coastal Studies Institute
Baton Rouge, LA 70803

and

Linda Mathies, Beth Nord, and Robert Gunn
Operations Division - Technical Support Branch (CELMN-OD-T)
U.S. Army Corps of Engineers - New Orleans District
New Orleans, LA 70160-0267

Baton Rouge, Louisiana
1997

TABLE OF CONTENTS

INTRODUCTION 2-1

DREDGED MATERIAL DISPOSAL HISTORY 2-4

FIELD SURVEY RESULTS 2-6
  Methodology 2-6
    Elevation Profile Surveys 2-6
    Vegetation Surveys 2-8
  Profiles 2-8
  Vegetative Character 2-13
    General Description 2-13
    Vegetative Community Types 2-13

GIS ANALYSIS RESULTS 2-14
  Shoreline Changes: 1990-1996 2-14
  Habitat Inventory 2-19
  Habitat Change 2-25

CONCLUSIONS 2-28

APPENDIX 2A 2A-1

LIST OF FIGURES

Figure 1. The location of the Mississippi River Gulf Outlet navigation channel - Mile 47-59 BUMP study area in Louisiana. 2-1

Figure 2. Location of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized. 2-3

Figure 3. The dredged material disposal history for the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area before November 1996, and the USACE-NOD designated disposal areas. 2-5

Figure 4. Location of the MRGO - Mile 47-59 BUMP study area profile transects. 2-7

Figure 5. Photograph of the MRGO - Mile 47-59 Bayou Bienvenue BUMP study site taken on November 7, 1996 showing the shallow open water, sparsely colonized by widely spaced clumps of *Spartina alterniflora*. 2-9

Figure 6. Photograph of the MRGO - Mile 47-59 Bayou Bienvenue BUMP study site taken on November 7, 1996 showing the existing saltmarsh protected by the earthen dike. 2-9

Figure 7. Elevation profile of the MRGO Bayou Bienvenue BUMP study site with vegetation data illustrated. 2-10

Figure 8. Photograph of the MRGO - Mile 47-59 Bayou Dupre (Area B) BUMP study site taken on November 7, 1996 of material added to the marsh as evidenced by mud cracks and the clumping appearance of the vegetation. 2-11

Figure 9. Photograph of the MRGO - Mile 47-59 Bayou Dupre BUMP study site taken on November 7, 1996 showing the thick growth of *Spartina alterniflora* saltmarsh in the interior of Disposal Area "B". 2-12

Figure 10. Elevation profile of the MRGO - Mile 47-59 Bayou Dupre (Area B) BUMP study site with vegetation data illustrated. 2-12

Figure 11. Graph of the area of the Mississippi River Gulf Outlet -Mile 47-59 BUMP study area over time, with and without the placement of dredged material. 2-15

Figure 12. Land loss/land gain map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area comparing December 1990 and November 1996. 2-16

Figure 13. Land loss/land gain map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area comparing December 1990 and November 1995 2-17

Figure 14. Land loss/land gain map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area comparing November 1995 and November 1996. 2-18

Figure 15. Habitat inventory map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area in December 1990. 2-20

Figure 16. Habitat inventory map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area in November 1995. 2-22

Figure 17. Habitat inventory map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area in November 1996. 2-24

Figure 18. Time series showing the changes in total area of each habitat in the MRGO - Mile 47-59 BUMP study area between December 1990 and November 1996. A) natural habitat changes. B) man-made habitat changes. 2-27

Figure 19. Map of the MRGO-Mile 47-59 BUMP study area showing the new habitats that developed between December 1990 and November 1996. 2-28

LIST OF TABLES

TABLE 1 MRGO - Mile 47 - 59 Area: 1990-1996 2-15

TABLE 2 December 1990 Habitat Inventory of the MRGO-Mile 47-59 BUMP Study Area 2-19

TABLE 3 November 1995 Habitat Inventory of the MRGO-Mile 47-59 BUMP Study Area 2-21

TABLE 4 November 1996 Habitat Inventory of the MRGO-Mile 47-59 BUMP Study Area 2-23

TABLE 5 Change in Total Acres of each Habitat in the MRGO-Mile 47-59 BUMP Study Area between 1990 and 1996 2-26

INTRODUCTION

The Mississippi River Gulf Outlet (MRGO) navigation channel - Mile 47-59 BUMP study area is located 10 miles southeast of New Orleans between MRGO Mile 47 and Mile 59 (Figure 1). The U.S. Army Corps of Engineers - New Orleans District (USACE-NOD) maintains this navigation channel through the abandoned St. Bernard delta complex. Because the St. Bernard delta complex is abandoned, it is experiencing rapid coastal erosion and wetland loss.

The Beneficial Use of dredged material Monitoring Program (BUMP) at Louisiana State University - Coastal Studies Institute (LSU-CSI) is documenting the beneficial use of dredged material using aerial photography, geographical information system (GIS) analysis, and field surveys through the sponsorship of the USACE-NOD. BUMP results are provided in map series, annual reports, and scientific literature.

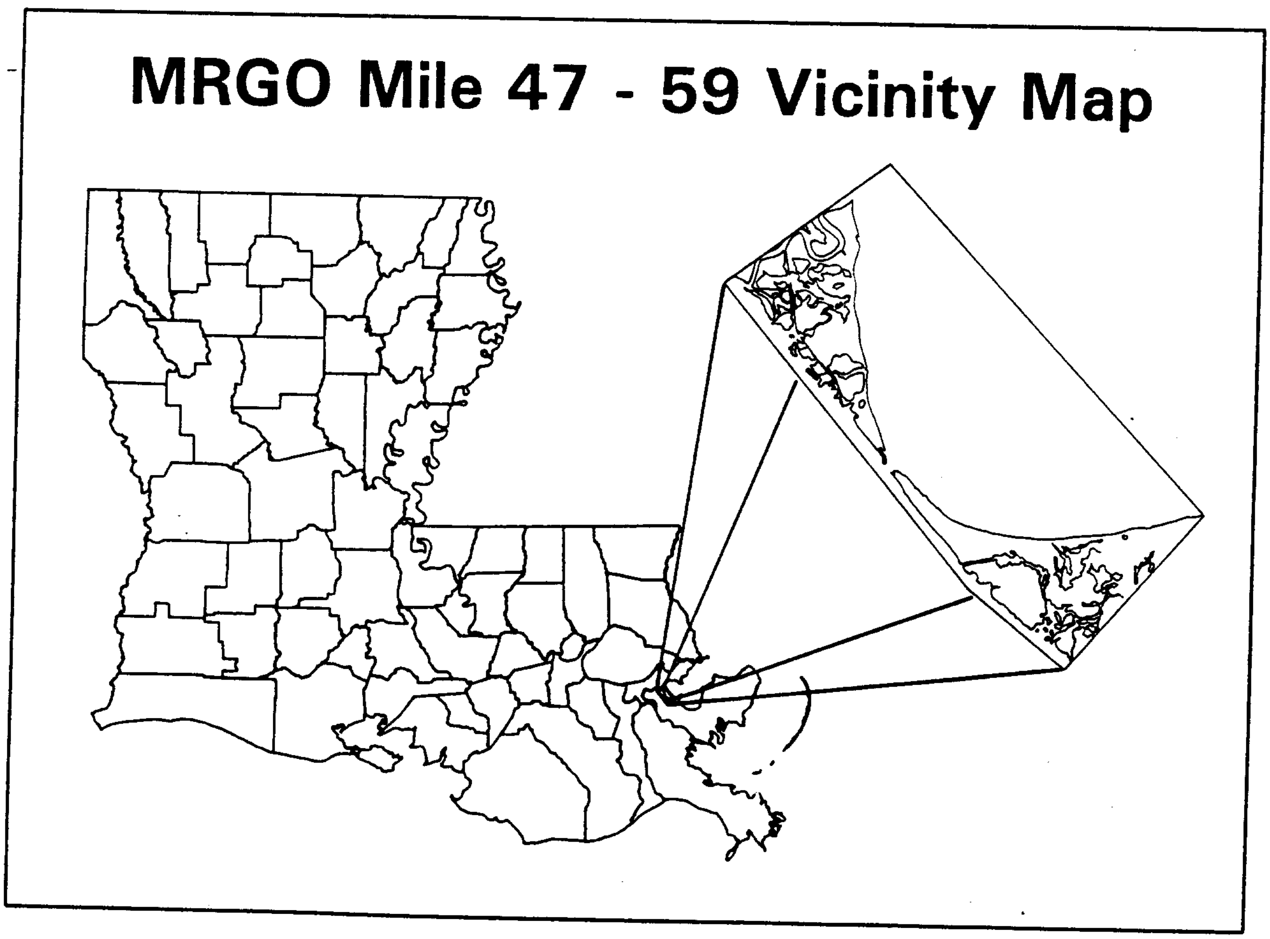


Figure 1. The location of the Mississippi River Gulf Outlet navigation channel - Mile 47-59 BUMP study area in Louisiana.

In this report, LSU presents the first results of the BUMP analysis at the Mississippi River Gulf Outlet navigation channel - Mile 47-59 study area, which represents monitoring results through the USACE-NOD 1996 Fiscal Year. This is the second part of the nine part Beneficial Use of dredged material Monitoring Program (BUMP), 1996 Final Report. The nine parts are:

- Part 1: Introduction and Methodology
- Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
- Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
- Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
- Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
- Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass
- Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Channel, Louisiana - Bay Chaland
- Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe
- Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Using aerial photography LSU classified the natural and man-made habitats in the study area for December 1990, November 1995, and November 1996, including habitat created during the USACE-NOD FY1996 maintenance event. Previous maintenance events occured in 1988, 1993 and 1995/96. There was no maintenance dredging between Mile 47 and 59 during FY94. Through the GIS analysis, these areas were calculated and changes were documented between 1990, 1995 and 1996. Field surveys were conducted on the beneficial use area created during the Fiscal Year 1993 and FY1996 maintenance events. Habitats were ground truthed and survey transects established to document vegetation species, stacking elevations, and subsidence. Figure 2 shows the areas of minimum air photo mosaic coverage and the limit of the digitized area.

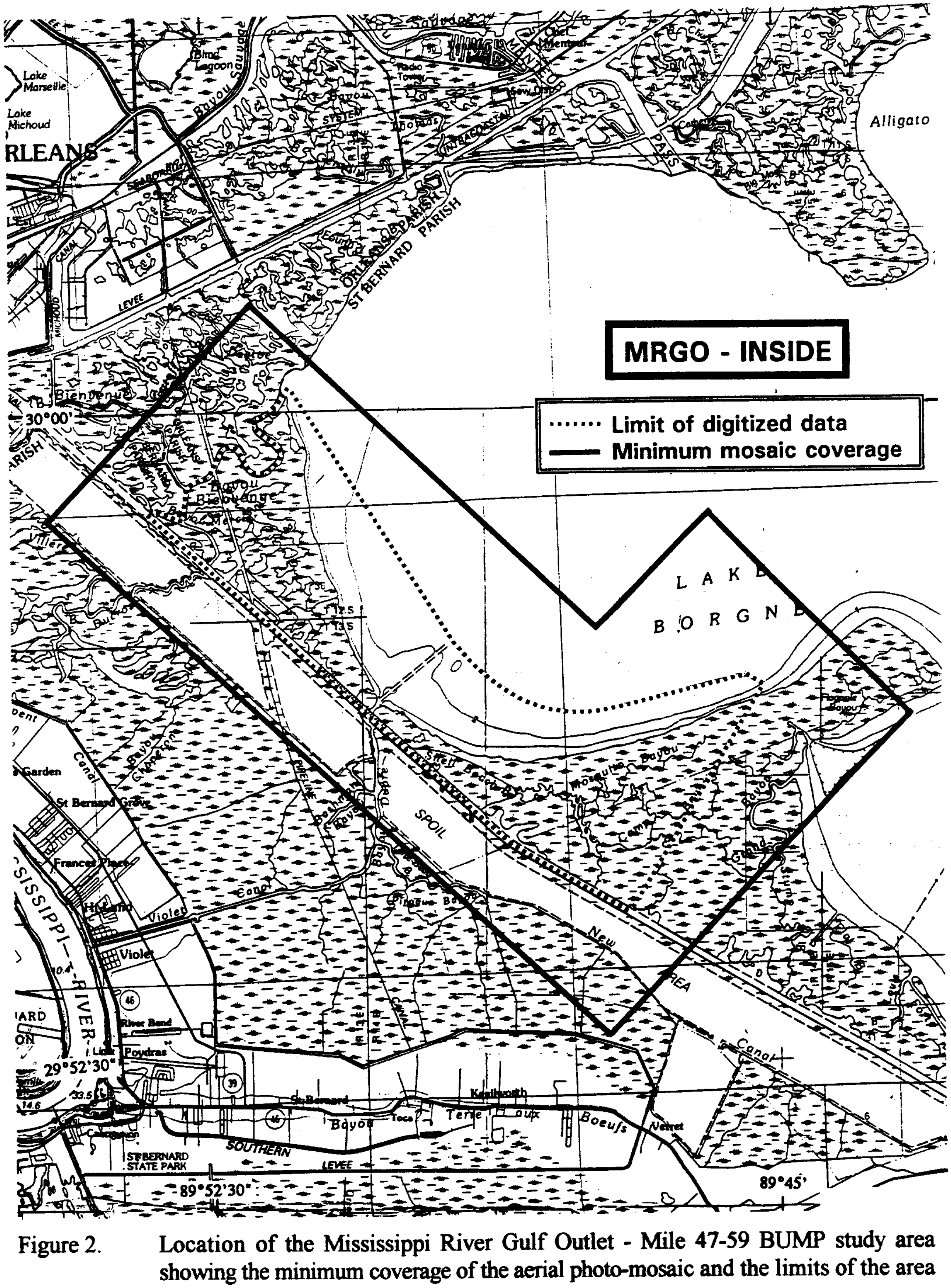


Figure 2. Location of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized.

DREDGED MATERIAL DISPOSAL HISTORY

The Rivers and Harbors Act of 1956 authorized the USACE-NOD to construct and maintain a deep draft navigation channel 36 feet deep by 500 feet wide from the Inner Harbor Navigation Canal in New Orleans to the Chandeleur Islands (Mile 66.0 to Mile 0) and a channel 38 feet deep by 600 feet wide from the islands to the 38 foot contour in the Gulf of Mexico (Mile 0 to Mile -9.0). Construction of the Mississippi River - Gulf Outlet (MRGO), Louisiana, navigation channel was initiated in 1958 and enlargement to full project dimensions was completed in 1968. Maintenance of discontinuous reaches of the channel has been accomplished on an annual basis since construction was completed.

Prior to and including the USACE-NOD 1988 Fiscal Year maintenance event, dredged material removed from the Mile 50 to Mile 60 reach of the channel was placed into an existing confined disposal facility located on the south bank of the navigation channel. For the 1993 and 1996 maintenance events, dredged material from the Mile 50 to Mile 60 reach of the channel was placed within confined areas to nourish or restore wetlands adjacent to existing marsh between Lake Borgne and the MRGO navigation channel. The initial height of the dredged material placed for wetland creation adjacent to the south jetty was not to exceed +3.0 feet Mean Low Gulf (MLG) (+2.2 National Geodetic Vertical Datum (NGVD)).

There was no maintenance dredging in the Mile 50 to Mile 60 reach of the navigation channel during FY 1994, during which time dike repairs and construction were completed. Figure 3 illustrates the dredged material disposal history for the MRGO-Mile 47-59 BUMP study area prior to November 1996.

MISSISSIPPI RIVER GULF OUTLET DREDGING HISTORY

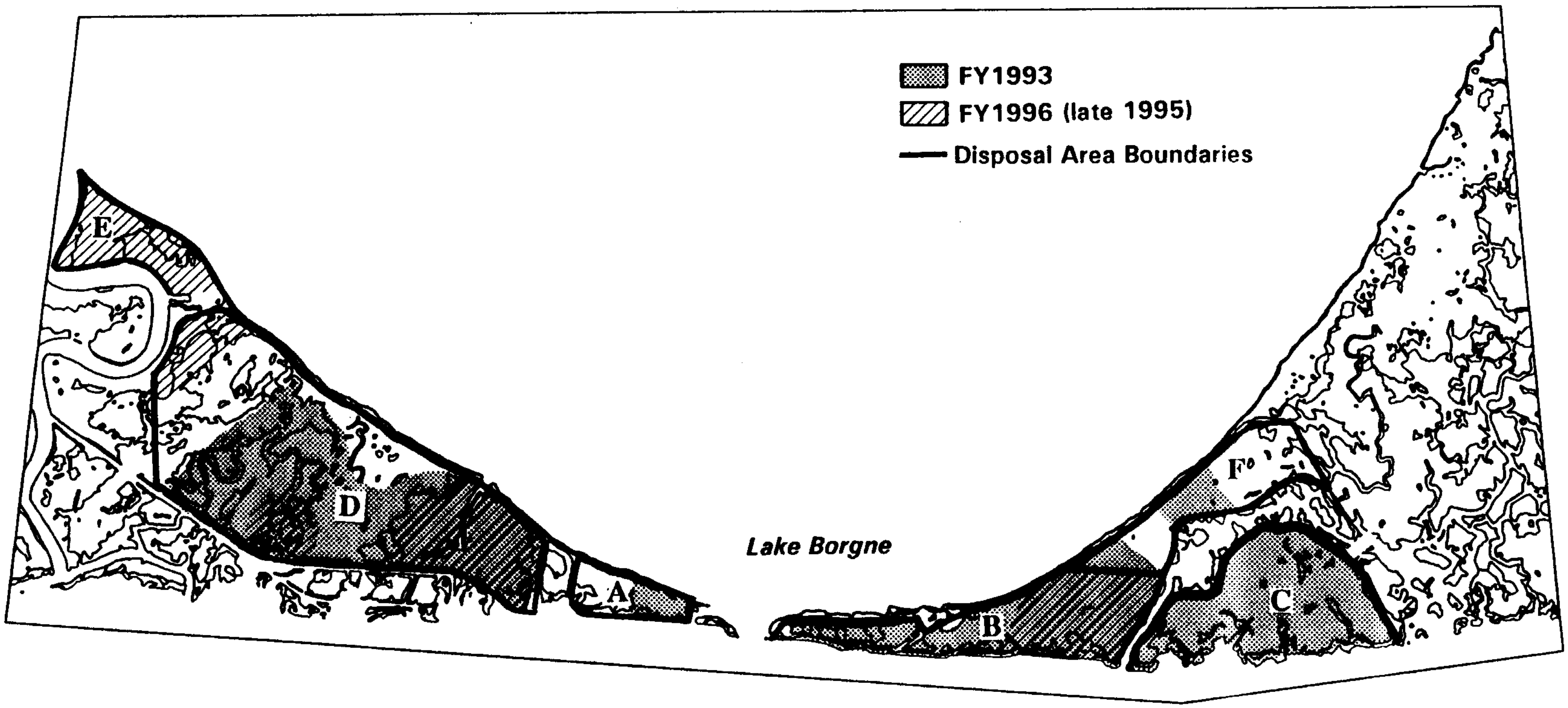


Figure 3. The dredged material disposal history for the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area before November 1996, and the USACE-NOD designated disposal areas.

FIELD SURVEY RESULTS

Methodology

Elevation Profile Surveys

The MRGO - Mile 47-59 study area is located between Lake Borgne and the MRGO navigation channel 10 miles southeast of New Orleans (Figure 2).

The collection of survey profiles was made in two phases. Phase-I involved assessing the characteristics of the study site to determine the most applicable position to setup a long-term monitoring program. This was accomplished using vertical aerial photography, reviewing dredging schedules and history, ground truthing the study area, defining varying vegetation and morphology, and assessing access possibilities. Based on these factors, one transect line was positioned at each of two widely spaced sites; one near Bayou Bienvenue to the northeast and one within an area designated by the USACE-NOD as "Area B" (Figure 4). An attempt was made to establish a third site, but access was denied to the methods we had at hand. Two stakes were permanently placed to represent the two profile transects. Permanent 1-inch diameter by 6-foot galvanized stakes were driven approximately 3.5 feet into the ground and secured with concrete. 8 ft. white, PVC pipes painted bright orange were placed over the stakes to help make relocation easier and to prevent damage from other transportation through the area. The position of the stakes was determined using a Global Positioning System (GPS).

Phase-II involved the actual collection of profile datum. In November 1996, profile surveys were conducted along the transects defined by the stakes during phase-I. One profile transect was collected from each site selected in the MRGO- Mile 47-59 area. Survey datum and profiles were collected using a Topcon GTS-300$_{DPG}$ Total-Station, tri-prism, and TDS48 Data Collection System. Horizontal accuracy of the GTS-300 is 0.25 ft ± 0.0125 ft., with a vertical accuracy of 0.45 ft ± 0.0125 ft. The maximum horizontal range with tri-prism is 3,525 ft. A Pathfinder Professional MC-5 global positioning system (GPS) device was used to record the horizontal positions of each stake, instrument location, the position and exact orientation of each transect line, and the location of vegetation encountered along the transect lines. The transect datum collected were processed, referenced to local tide gages, and entered into a graphic software program to produce topographic profiles.

The topographic profiles for MRGO - Mile 47-59 BUMP study area were constructed in reference to the tide gage at Shell Beach, Lake Borgne, Lousiana (29°52' N / 89°41' W). The mean diurnal tidal range for the MRGO - Mile 47-59 BUMP study area is published as 1.4 ft. Profiles here were 950 and 1200 feet in length. Maximum relief along profile A-A' at the Bayou Bienvenue site was 2.76 feet, with an average relief of 1.04 feet. Profile B-B' at the Area B site exhibited a maximum relief of 4.77 feet, with an average relief of 1.48 feet. The area was characteristically defined as a low relief salt marsh throughout. The surficial sedimentology of the peninsula is composed of tidalite type sediments (silty clays, with very fine quartz sand).

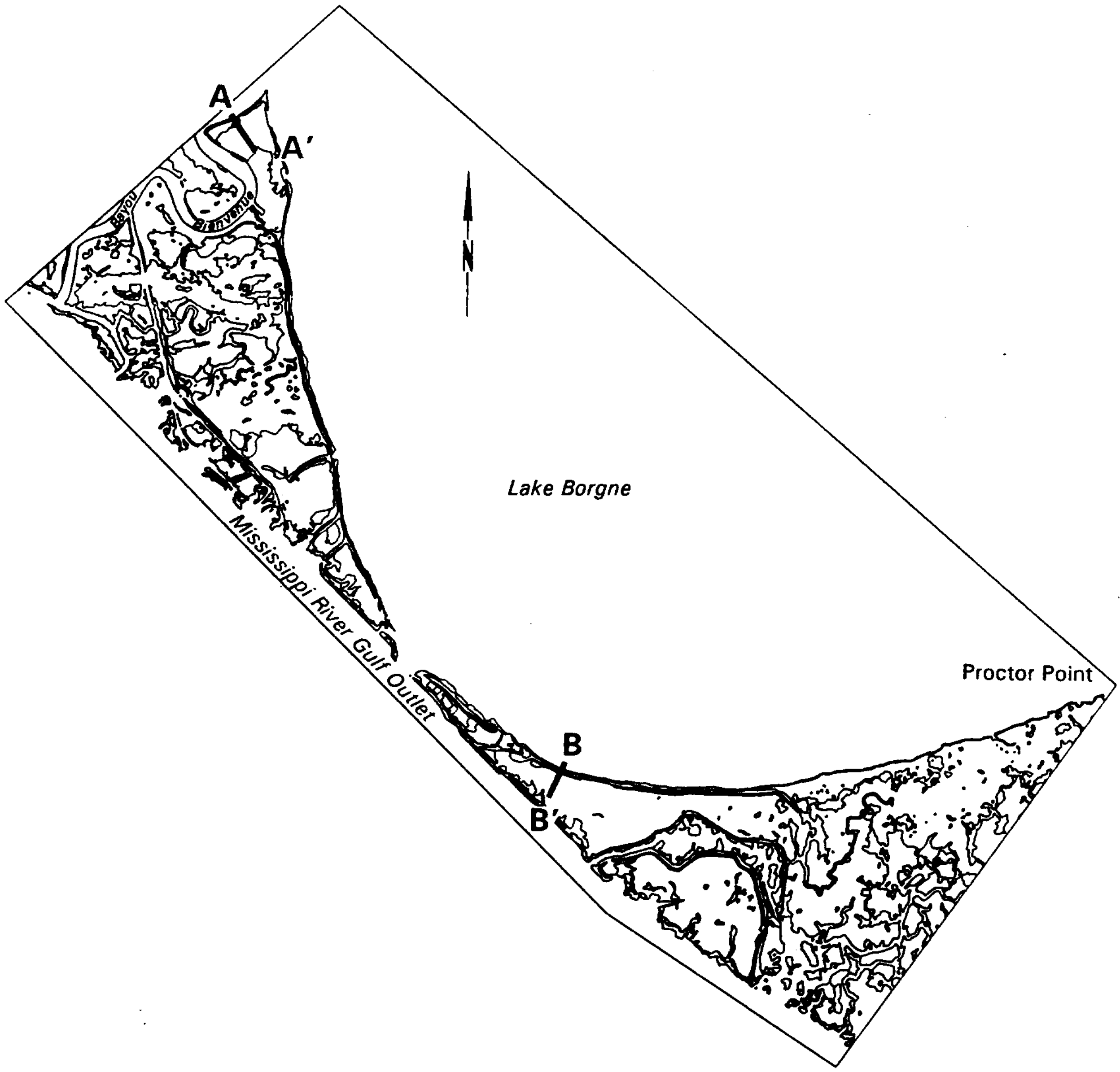


Figure 4. Location of the MRGO - Mile 47-59 BUMP study area profile transects.

Vegetation Surveys

Ground truthing for vegetative species composition and habitat verification was done in November 1996. Species composition was determined within an approximate six-foot swath along each transect. No submerged aquatic species were considered for this report. Plants were identified in the field with only representative specimens taken for confirmation by taxonomic keys and/or verification by the LSU Department of Plant Biology. The better specimens and uncommon specimens were entered into the LSU herbarium collection; all others were archived by the author. The percent composition of each species was visually estimated in order to determine the relative abundance and dominance of species for habitat determinations. These percentages were not intended to provide scientific ratios or statistics. The species list included in Appendix 2A of this report is not complete; it reflects only those species that were readily observed during the profiling period. Some plants can only be identified during a short flowering period which may not have coincided with the time of the profile collection or ground truthing, and therefore can not be included in the list other than by a broad classification.

Profiles

The 1996 profiles were established with permanent 1-inch diameter by 6-foot galvanized stakes that were driven approximately 3.5 feet into the ground and secured with concrete. One stake was placed at each site to define each profile.

Bayou Bienvenue transect

The Bayou Bienvenue transect is located within the USACE-NOD Disposal Area "E" of the MRGO - Mile 47-59 BUMP study site, to the east of where the bayou empties into Lake Borgne, and is generally defined by the shorelines of these waterbodies (Figure 4). The construction of this site was initiated during the USACE-NOD FY1993 maintenance event and consisted of an earthen dike encircling deteriorating saltmarsh. The dike is broken in several places and the enclosed area is open to tidal action. This site included a vast amount of shallow, open water. The material within the encircling dike was extremely fine, soft mud, sparsely colonized by widely spaced clumps of saltmarsh (Figure 5).

The transect was delineated by 1 permanent stake set in the west, shell and earth retaining dike along the east bank of Bayou Bienvenue, and one temporary stake set in the soft substrate of the old marsh at the east side of the site. It traversed the old deteriorating marsh, the shallow open water, and new colonizing marsh next to the retaining dike (Figure 6).

The profile here had a length of 1200 feet. The maximum relief along the axis is 2.76 feet, with an average relief of 1.04 feet. The profile indicates that the island is typically characterized as a mud flat colonized by saltmarsh (Figure 7).

Figure 5. Photograph of the MRGO - Mile 47-59 Bayou Bienvenue BUMP study site taken on November 7, 1996 showing the shallow open water, sparsely colonized by widely spaced clumps of *Spartina alterniflora*. The view is from the back stake along the transect to the front stake that is just to the left of the marsh clump.

Figure 6. Photograph of the MRGO - Mile 47-59 Bayou Bienvenue BUMP study site taken on November 7, 1996 showing the existing saltmarsh protected by the earthen dike. View is from front stake toward the back stake which is placed in old marsh in the background.

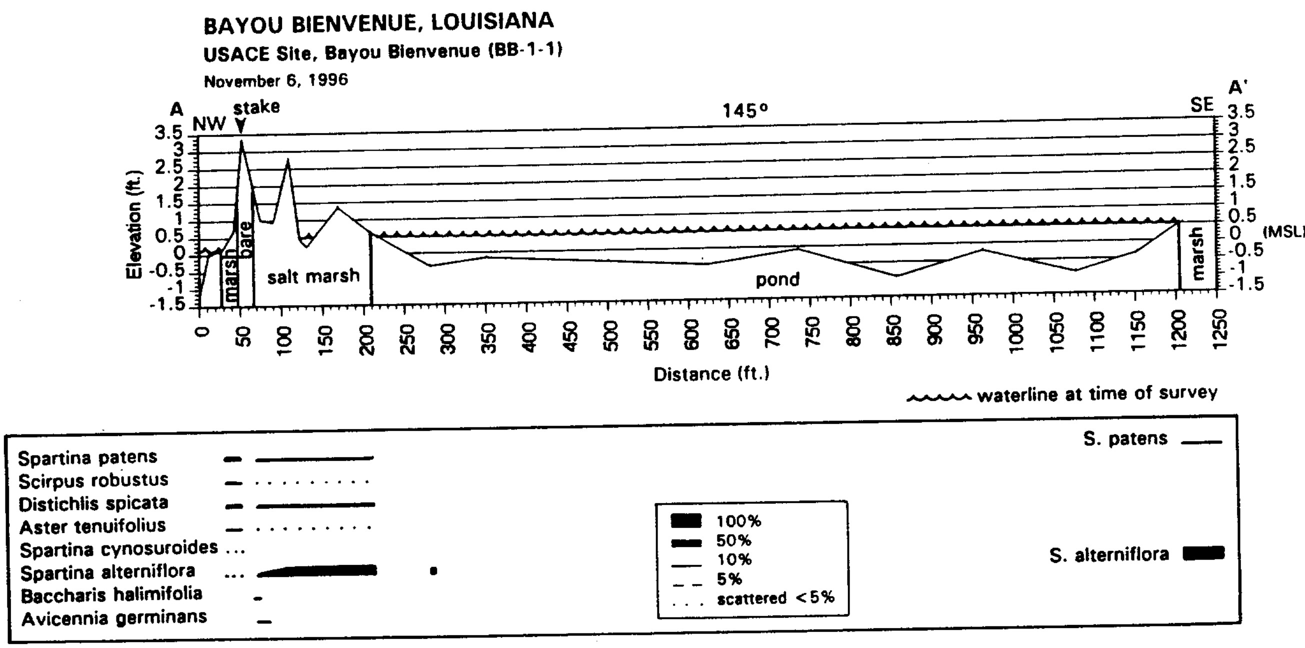


Figure 7. Elevation profile of the MRGO Bayou Bienvenue BUMP study site with vegetation data illustrated.

Bayou Dupre transect
The Bayou Dupre transect is located within the USACE-NOD Disposal Area "B" (Figure 3) to the east side of the MRGO - Mile 47-59 BUMP study area (Figure 4). An earthen levee was constructed around existing saltmarsh and material was filled in around the marsh during the 1993 and 1996 maintenance events (Figure 8). A shallow, water-filled borrow canal runs parallel to the levee on the inland side. The substrate was solid, compacted clay and silt and was well colonized by salt marsh (Figure 9). The nearshore was steep and of a sandy substrate.

The transect was delineated by one stake set in the top of the earthen levee on the north side of the site, near the shoreline of Lake Borgne and near the west end of the borrow canal east of the trees. The transect was set perpendicular to the Lake Borgne shoreline.

The profile here was 950 feet in length. The maximum relief was 4.77 feet, with an average relief of 1.48 feet. The profiles indicate that the area is typically characterized as a low relief saltmarsh (Figure 10).

Figure 8. Photograph of the MRGO - Mile 47-59 Bayou Dupre (Area B) BUMP study site taken on November 7, 1996 of material added to the marsh as evidenced by mud cracks and the clumping appearance of the vegetation.

Figure 9. Photograph of the MRGO - Mile 47-59 Bayou Dupre BUMP study site taken on November 7, 1996 showing the thick growth of *Spartina alterniflora* saltmarsh in the interior of Disposal Area "B".

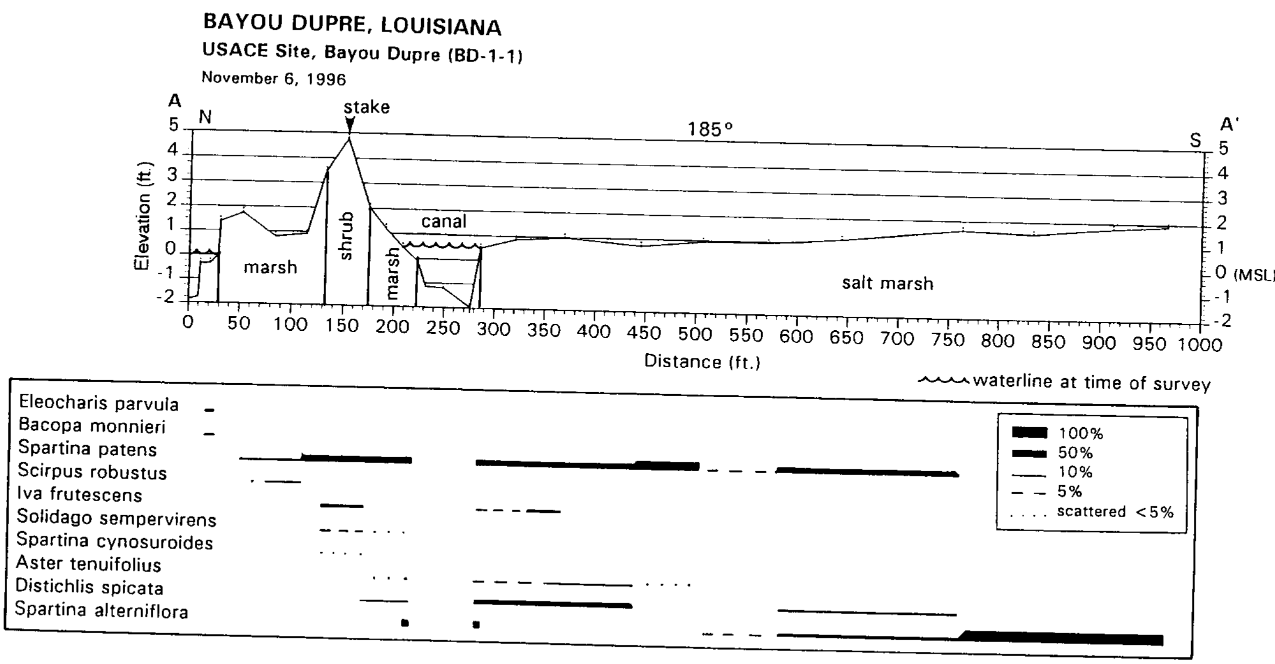


Figure 10. Elevation profile of the MRGO - Mile 47-59 Bayou Dupre (Area B) BUMP study site with vegetation data illustrated.

Vegetative Character

General Description

The overall marsh type for this area would be classified as salt marsh. The only other vegetative habitat found at this site was a narrow shrub/scrub zone occupying the ridge created to act as a retaining dike that generally paralleled the shoreline. The substrate was very soft, fine-grained silt and mud.

Vegetative Community Types

The salt marsh in the study area was represented by *Spartina alterniflora* and *Distichlis spicata*, with a variety of other species noticeable, such as *Aster tenuifolius*, *Spartina patens*, and *Scirpus sp.* growing thickly in older deposits and just beginning to colonize throughout the newly deposited mud flat.

Shrub communities usually indicate older, more stable, elevated areas. The narrow shrub zone occupying the earthen dike was primarily 5-6 foot *Iva frutescens* with some *Baccharis halimifolia* and an understory of *Spartina patens*, *Distichlis spicata*, and *Solidago sempervirens*.

GIS ANALYSIS RESULTS

Shoreline Changes: 1990-1996

Figures 11 graphs the spatial history of the MRGO - Mile 47-59 BUMP study area between December 1990 and November 1996 from the data in Table 1. In December 1990, the MRGO - Mile 47-59 BUMP study area was measured at 3618.0 acres. The study area in November 1996 was measured at 3463.0 acres. This is a cumulative area decrease of -155.0 acres or a decrease in area of -4 percent for the 5.9 year period at an overall rate of 26.3 acres per year. There was an overall loss of 645.9 acres of natural habitats, offset by the creation of +417.5 acres due to the beneficial use of dredged materials. Without the contribution of the new habitats due to the beneficial placement of dredged material, the total coastal land loss in the study area would have exceeded -572.5 acres at a rate of -97.0 acres per year. Figure 12 illustrates the pattern of land loss and gain in the MRGO - Mile 47-59 study area.

Figure 13 depicts the coastal land loss history for the MRGO - Mile 47-59 BUMP study area between December 1990 and November 1995. The total area of the MRGO - Mile 47-59 decreased by -173.3 acres at a rate of -35.4 acres per year for this 4.9 year period. The primary area of land loss took place within the interior marsh as a result of subsidence and natural marsh degradation. This was offset by an increase in BUMP-made area of +394.8 acres as marsh colonization within USACE-NOD disposal areas.

Figure 14 depicts the coastal land loss history for the MRGO - Mile 47-59 BUMP study area between November 1995 and November 1996. The total area of the MRGO - Mile 47-59 increased by+18.3 acres at a rate of +18.3 acres per year for this one year period. The primary areas of land loss took place in the natural habitats as a result of shoreline erosion and iinterior pond development. This was enhanced further by an increase in BUMP-made area of +22.7 acres as marsh colonization within USACE-NOD disposal areas.

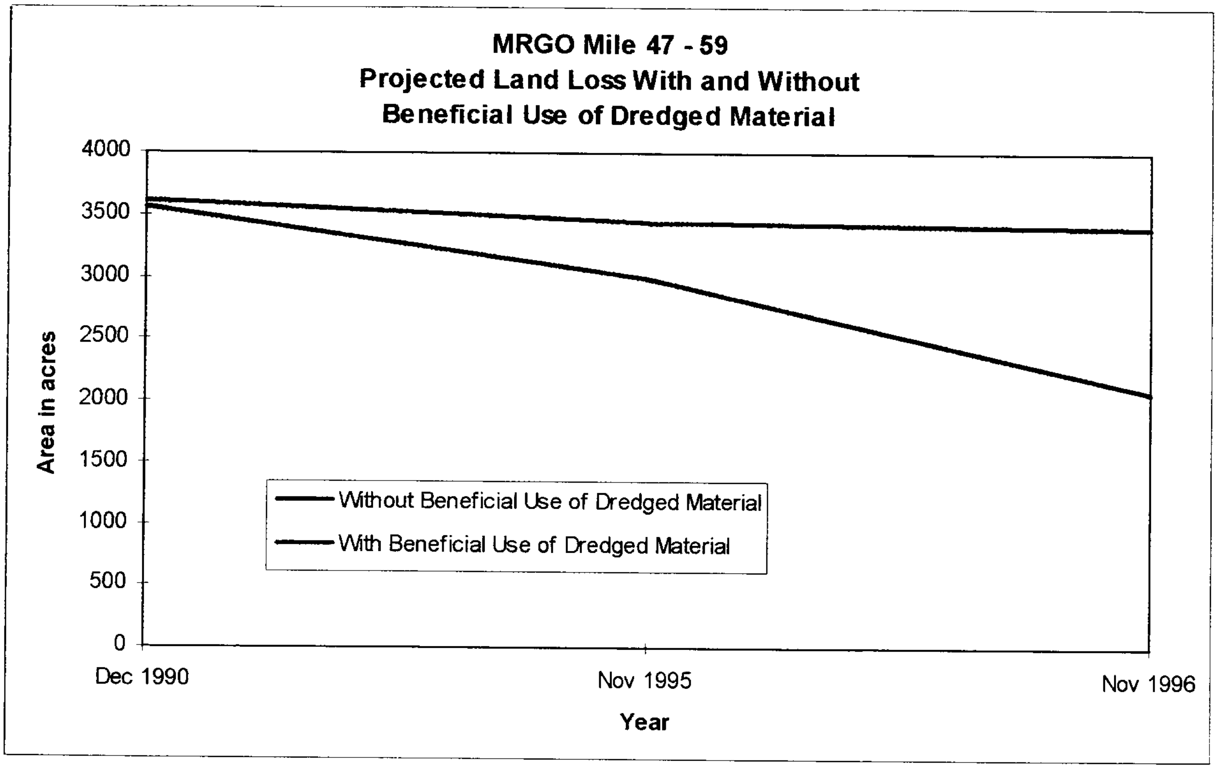
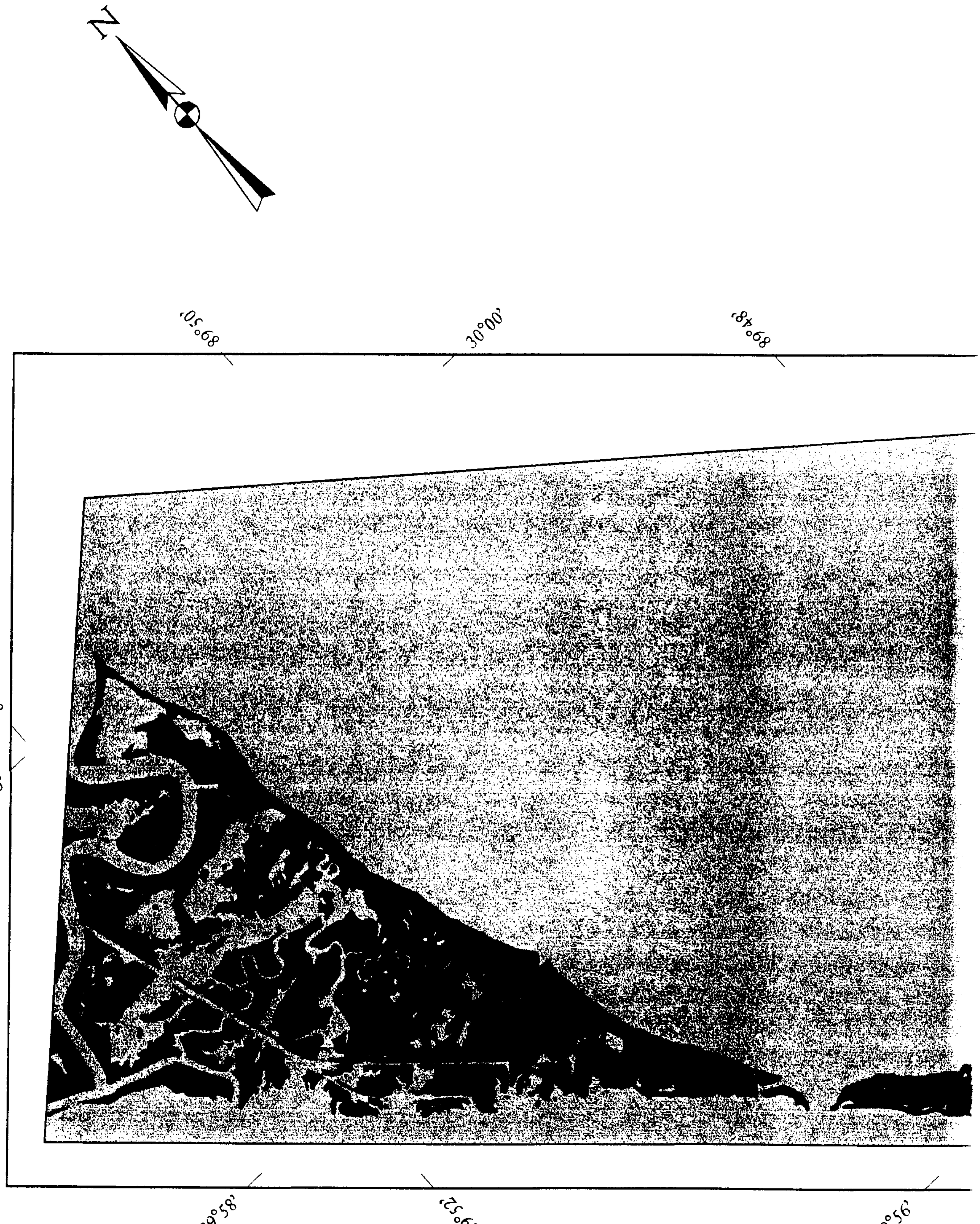


Figure 11. Graph of the area of the Mississippi River Gulf Outlet -Mile 47-59 BUMP study area over time, with and without the placement of dredged material.

TABLE 1
MRGO -Mile 47-59 Area: 1990-1996

Area in acres	Dec 1990	Nov 1995	Nov 1996
Natural Areas	3548.7	2920.1	2902.8
Non-BUMP Man-made Areas	10.4	70.8	83.8
BUMP Man-made Areas	58.9	453.7	476.4
Total	3618.0	3444.7	3463.0



1

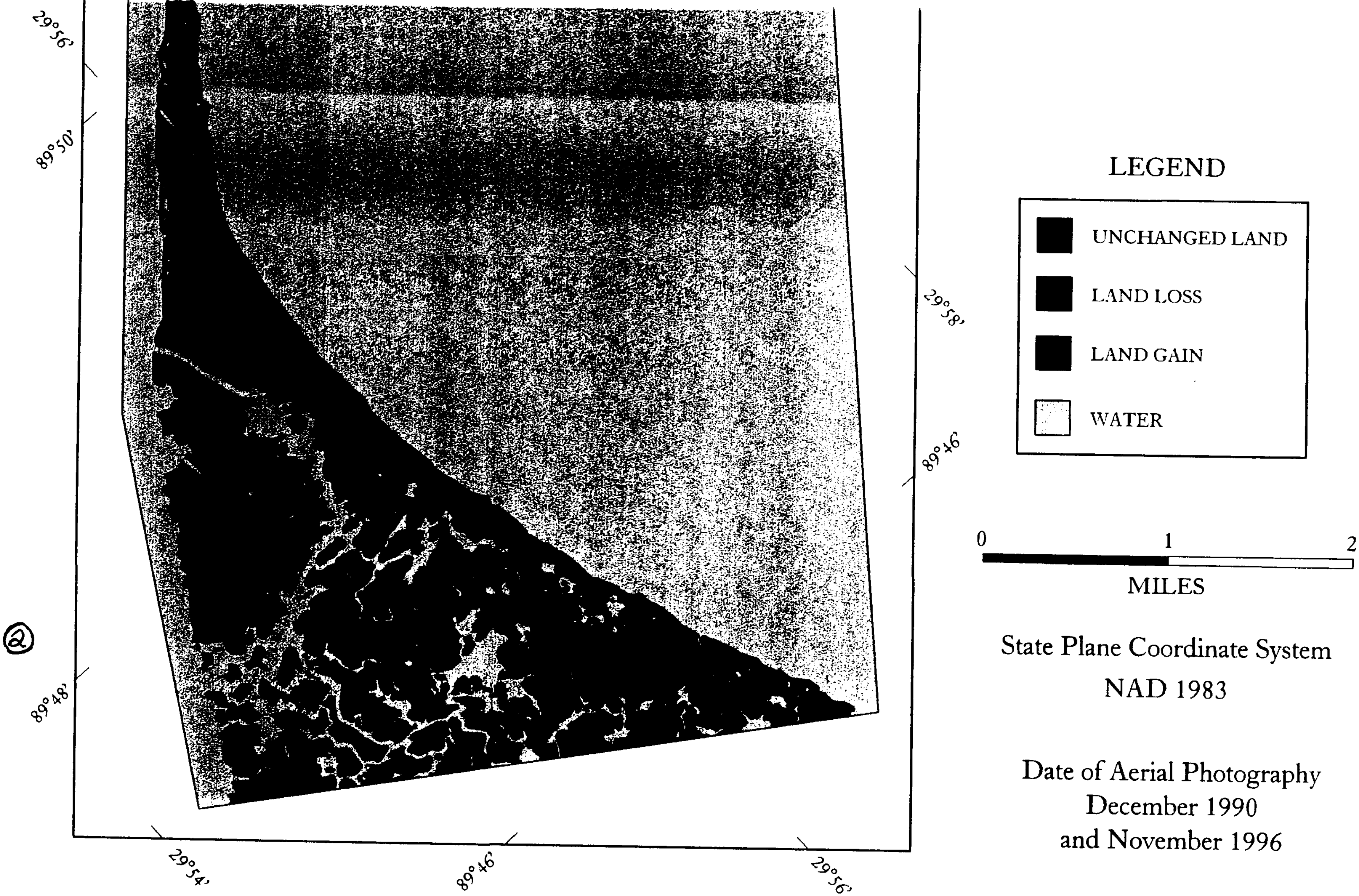
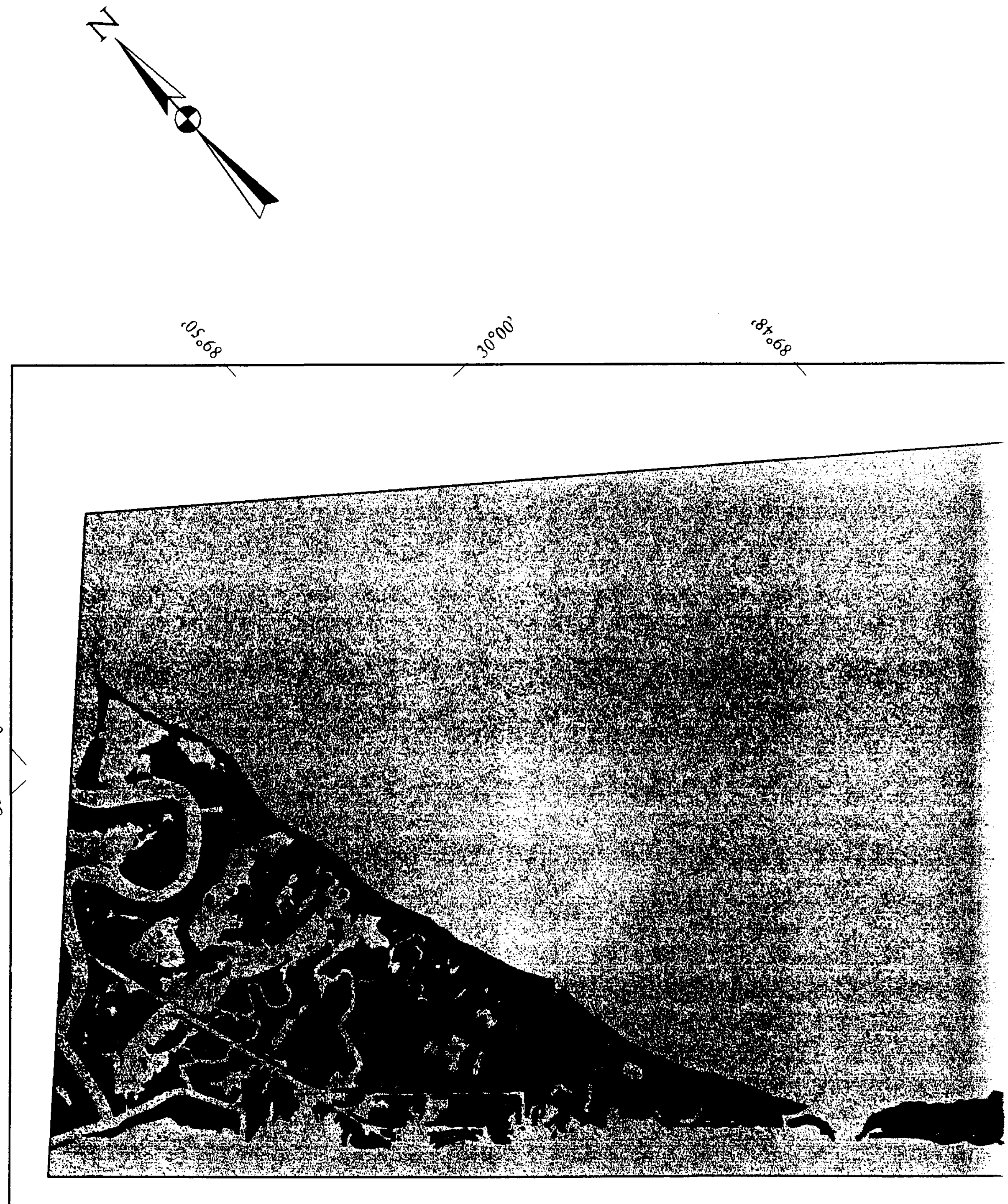


Figure 12. Land loss/land gain map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area comparing December 1990 and November 1996.



1

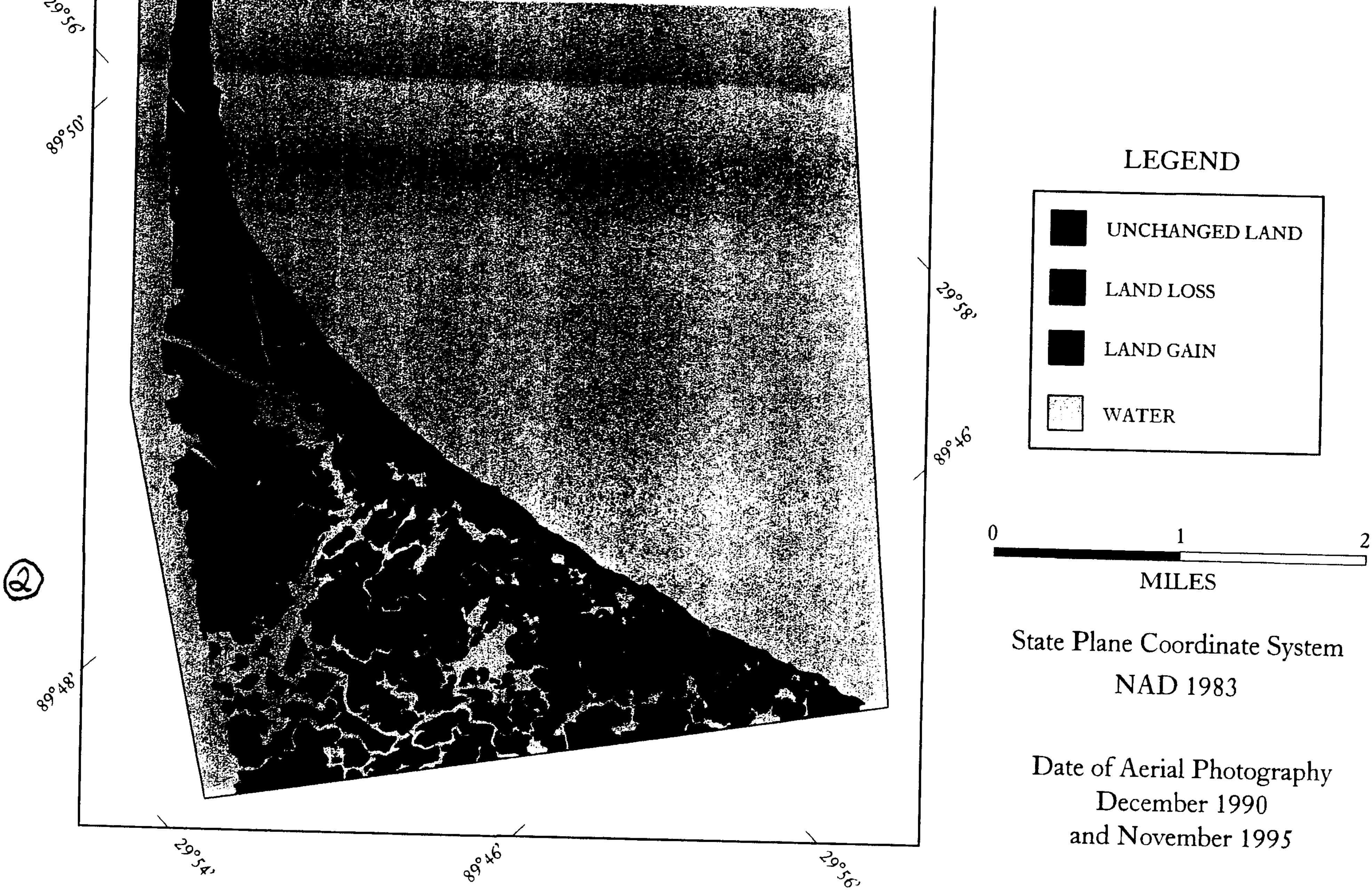
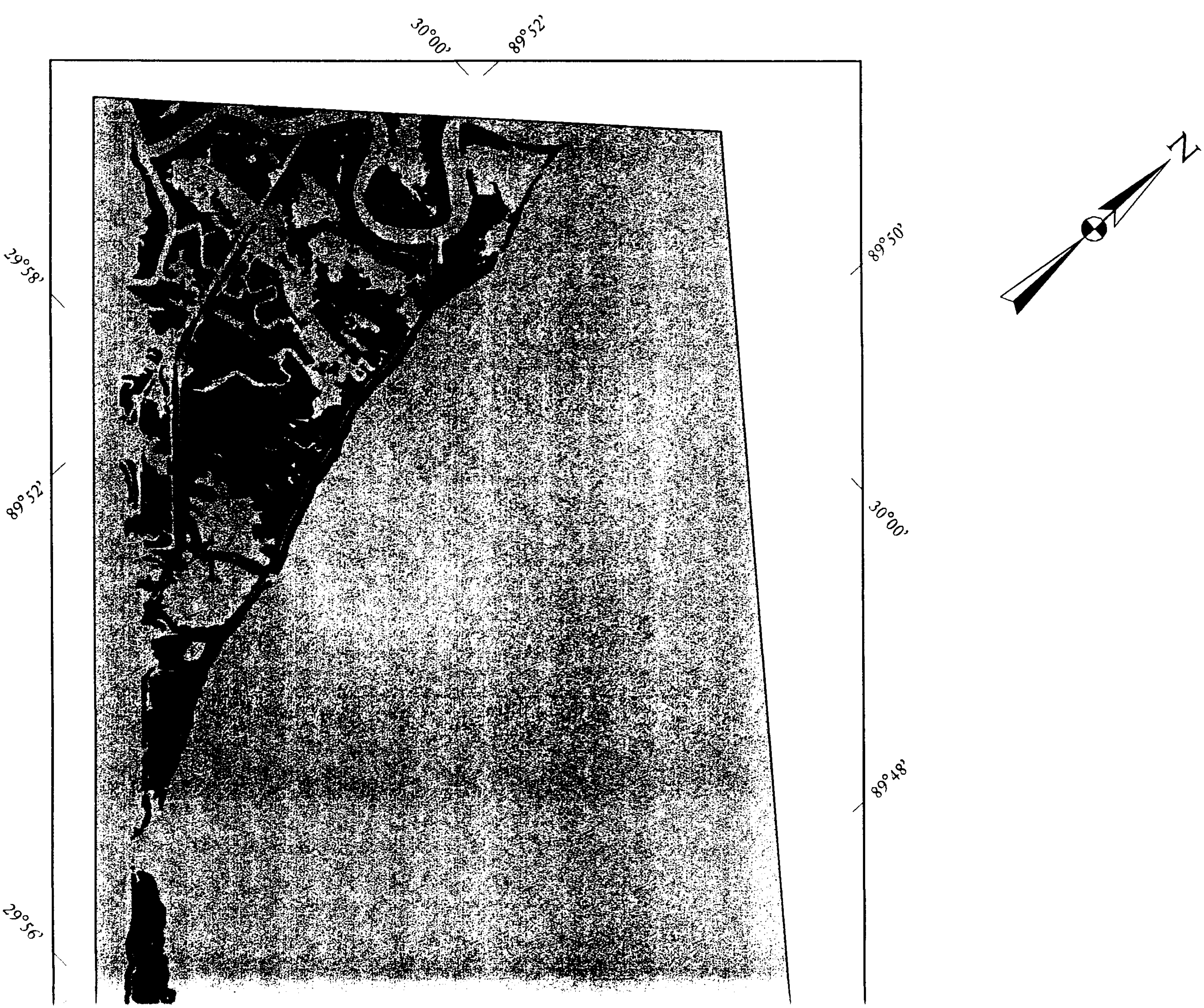


Figure 13. Land loss/land gain map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area comparing December 1990 and November 1995.



①

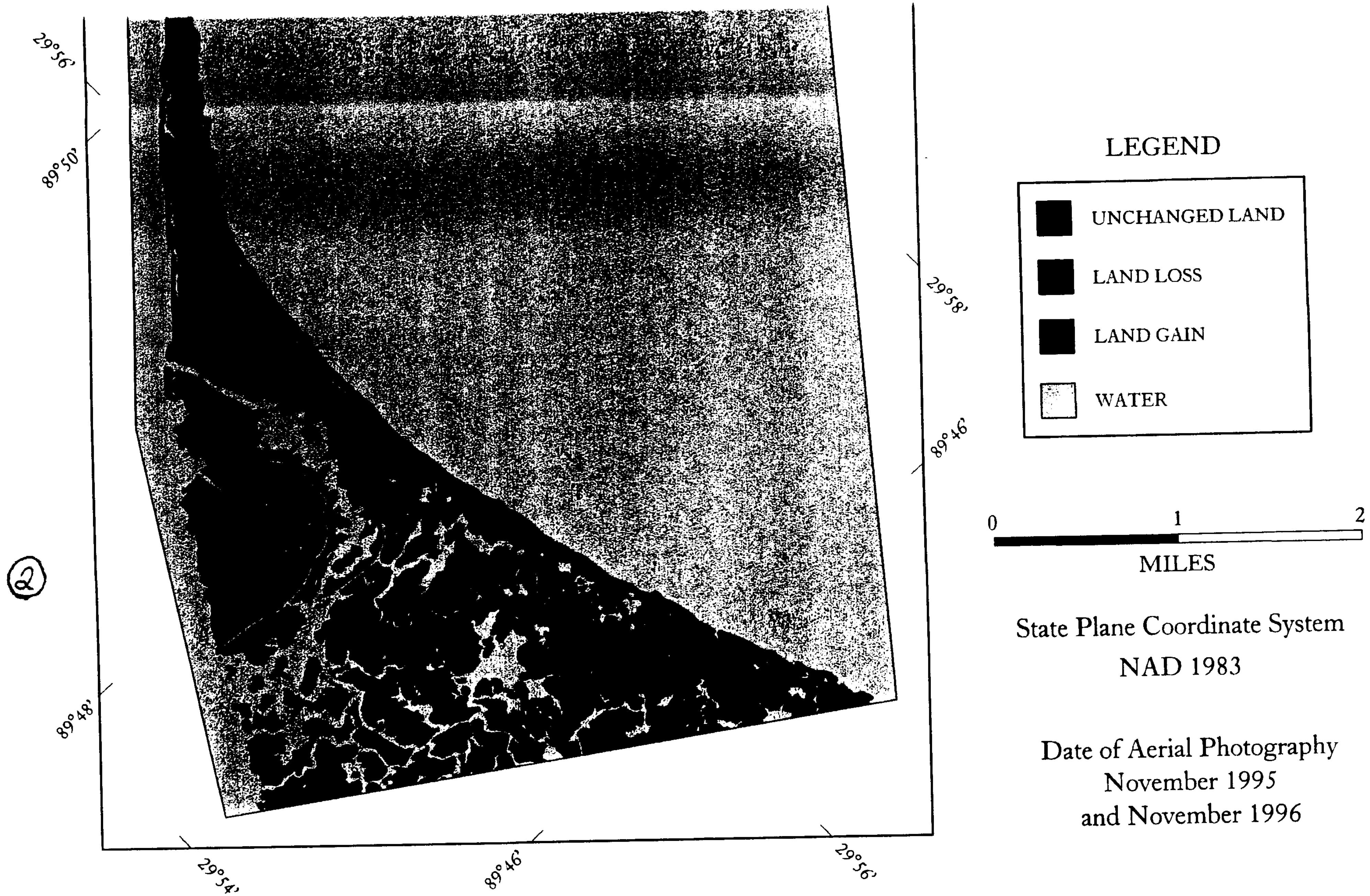


Figure 14. Land loss/land gain map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area comparing November 1995 and November 1996.

Habitat Inventory

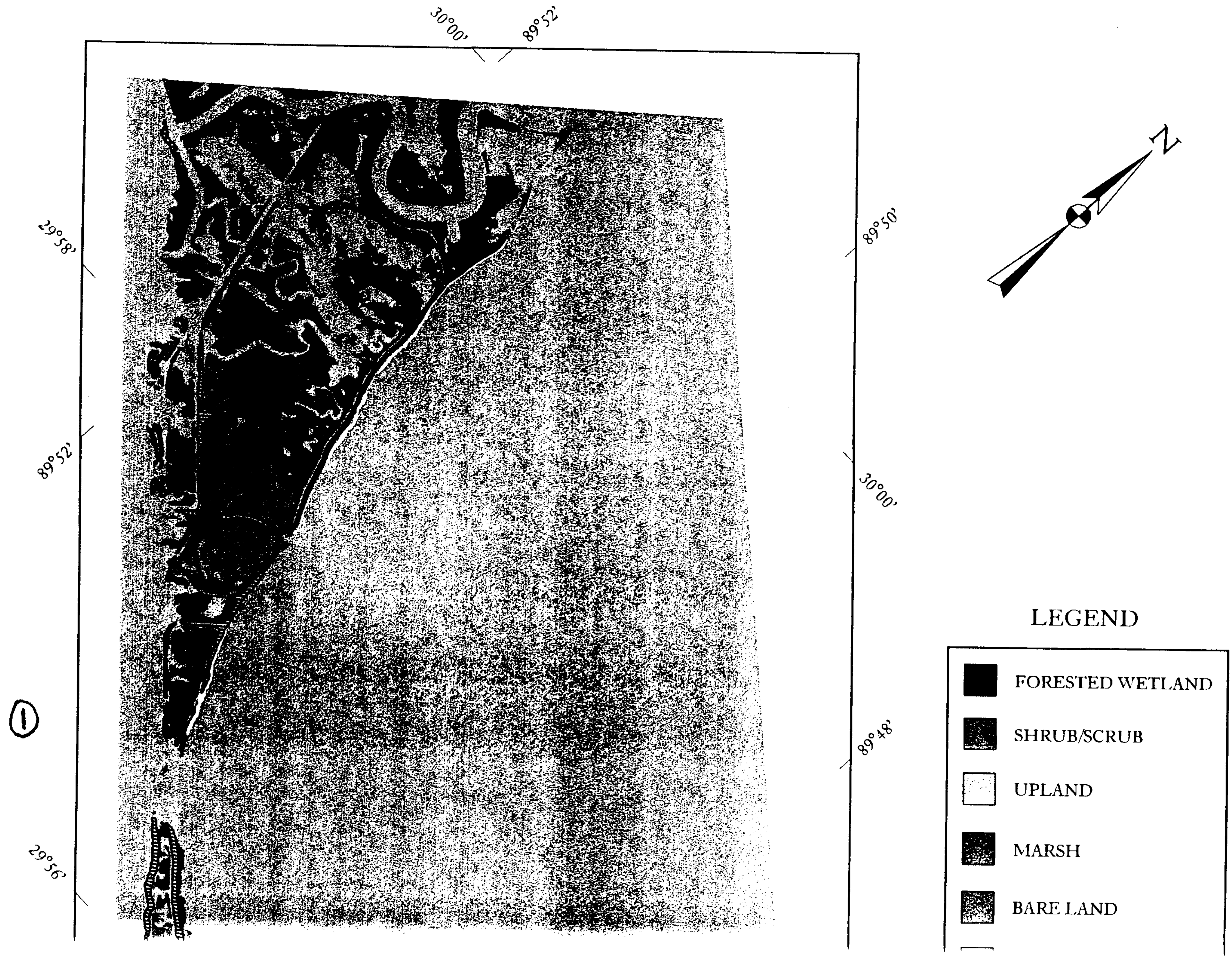
The aerial photographic interpretation combined with field surveys identified six major habitat types in the MRGO - Mile 47-59 BUMP study area. These habitats are further classified as natural, BUMP man-made, and non-BUMP man-made. The natural class identifies natural deltaic processes as responsible for habitat creation. The BUMP man-made (BUMP-made) class identifies the habitats created by the beneficial placement of dredged materials by the USACE-NOD. The non-BUMP man-made class (other-made) separates areas created that were not part of the BUMP effort, such as areas created in association with the oil industry access and pipeline canals. On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

Table 2 lists the areas of the six habitat types found in the MRGO - Mile 47-59 BUMP study area in December 1990. The location and arrangement of these habitats is presented in figure 15. The total area of the MRGO - Mile 47-59 site was 3618.0 acres. Of this total, 3548.7 acres were natural and 69.3 acres were man-made including 10.4 acres of other man-made and 58.9 acres of BUMP-made habitats, or 98.1 percent were natural, 0.3percent were man-made, and 1.7 percent were BUMP-made. In order of decreasing size and importance, the largest habitat found was natural marsh (3063.7 acres) followed by natural bare land (237.7 acres), natural upland (113.5 acres), natural shrub/scrub (68.9 acres), natural beach (64.9 acres), BUMP-made upland (28.8 acres), BUMP-made shrub/scrub (23.3 acres), other-made shrub/scrub (5.2 acres), BUMP-made bare land (4.1 acres), other-made upland (2.8 acres), BUMP-made marsh (2.7 acres) and other-made trees (1.1 acres).

In terms of habitat totals, marsh (3067.7 acres or 85%) dominated the landscape.

TABLE 2
December 1990 Habitat Inventory of the MRGO-Mile 47-59 BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP-MADE
Marsh	3067.7	3063.7	1.3	2.7
Upland	145.1	113.5	2.8	28.8
Shrub/Scrub	97.4	68.9	5.2	23.3
Trees	1.1	0	1.1	0
Bare Land	241.8	237.7	0	4.1
Beach	64.9	64.9	0	0
Habitat Total	3618.1	3548.7	10.4	58.9


30°00'
89°52'
29°58'
89°52'
29°56'
89°50'
30°00'
89°48'
N
LEGEND
FORESTED WETLAND
SHRUB/SCRUB
UPLAND
MARSH
BARE LAND
1

2

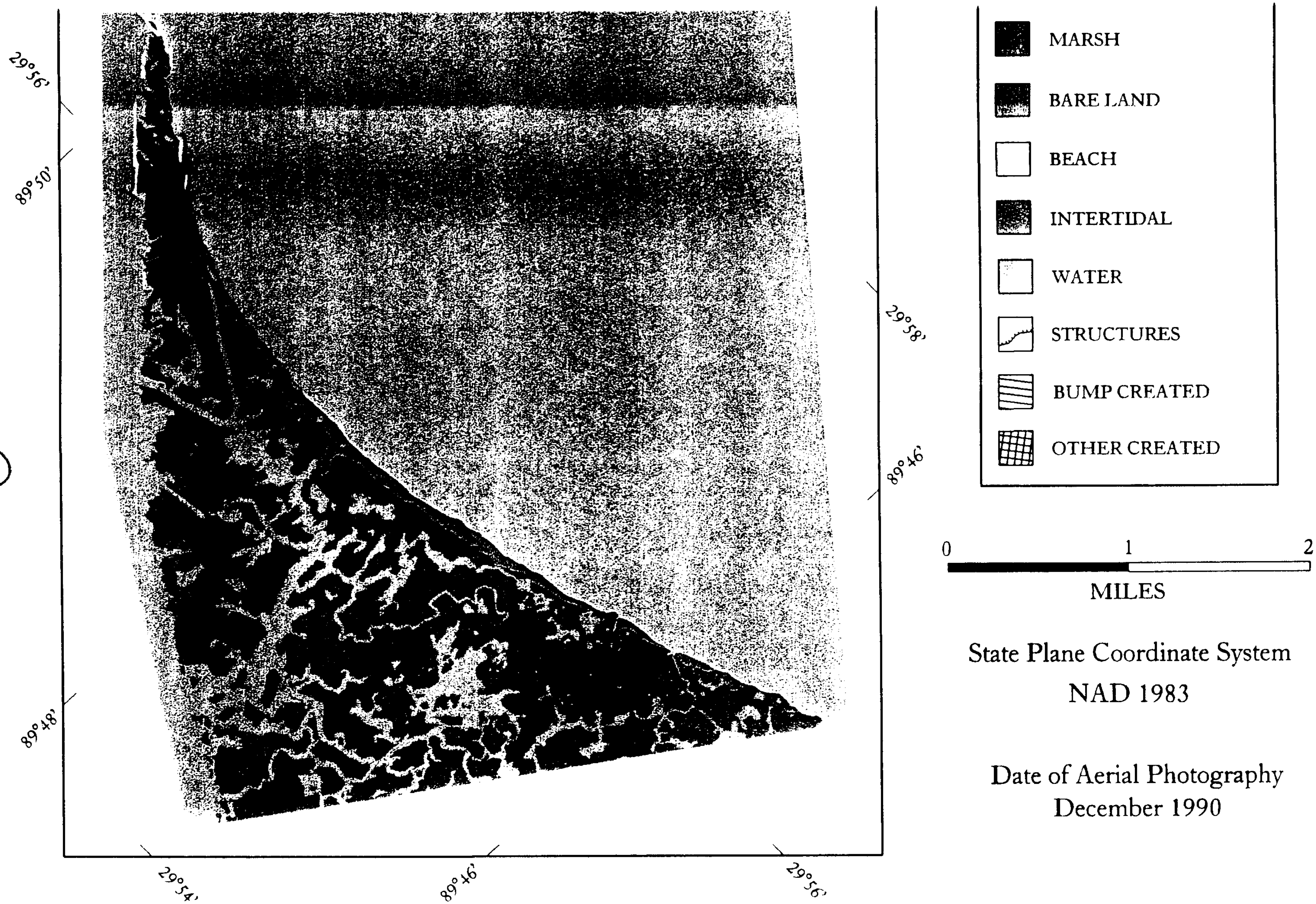


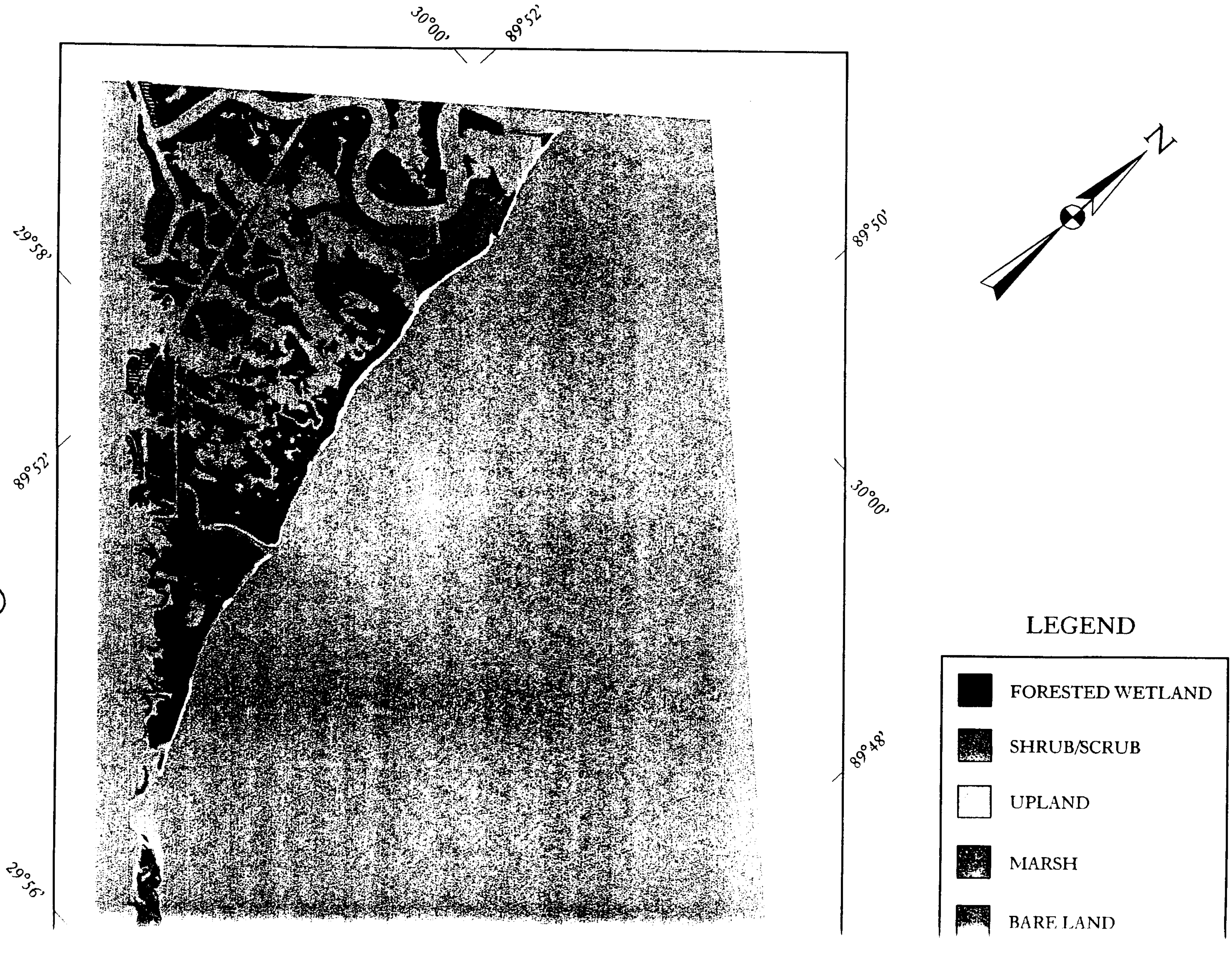
Figure 15. Habitat inventory map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area in December 1990.

Table 3 lists the areas of the six habitats found in the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area in November 1995. The location and arrangement of these habitats is presented in figure 16. In 1995, the total area of the MRGO - Mile 47-59 BUMP study area was calculated at 3444.7 acres. Of this total, 2920.1 acres were natural and 524.5 acres were man-made including 70.8 acres of other-made and 453.7 acres of BUMP-made, or 84.8 percent was natural, 2.1 percent was other-made, and 13.2 percent was BUMP-made. In order of decreasing size and importance, the largest habitat found is natural marsh (2715.2 acres) followed by BUMP-made marsh (221.5 acres), BUMP-made upland (187.4 acres), natural upland (64.6 acres), natural bare land (55.2 acres), natural beach (43.1 acres), natural shrub/scrub (42.0 acres), other-made shrub/scrub (38.0 acres), BUMP-made bare land (33.3 acres), other-made trees (19.1 acres), other-made upland (11.6 acres), BUMP-made shrub/scrub (11.5 acres), other-made marsh (1.2 acres), and other-made bare land (0.9 acres). The 1995 habitat inventory did not identify any natural trees, other-made beach or BUMP-made beach.

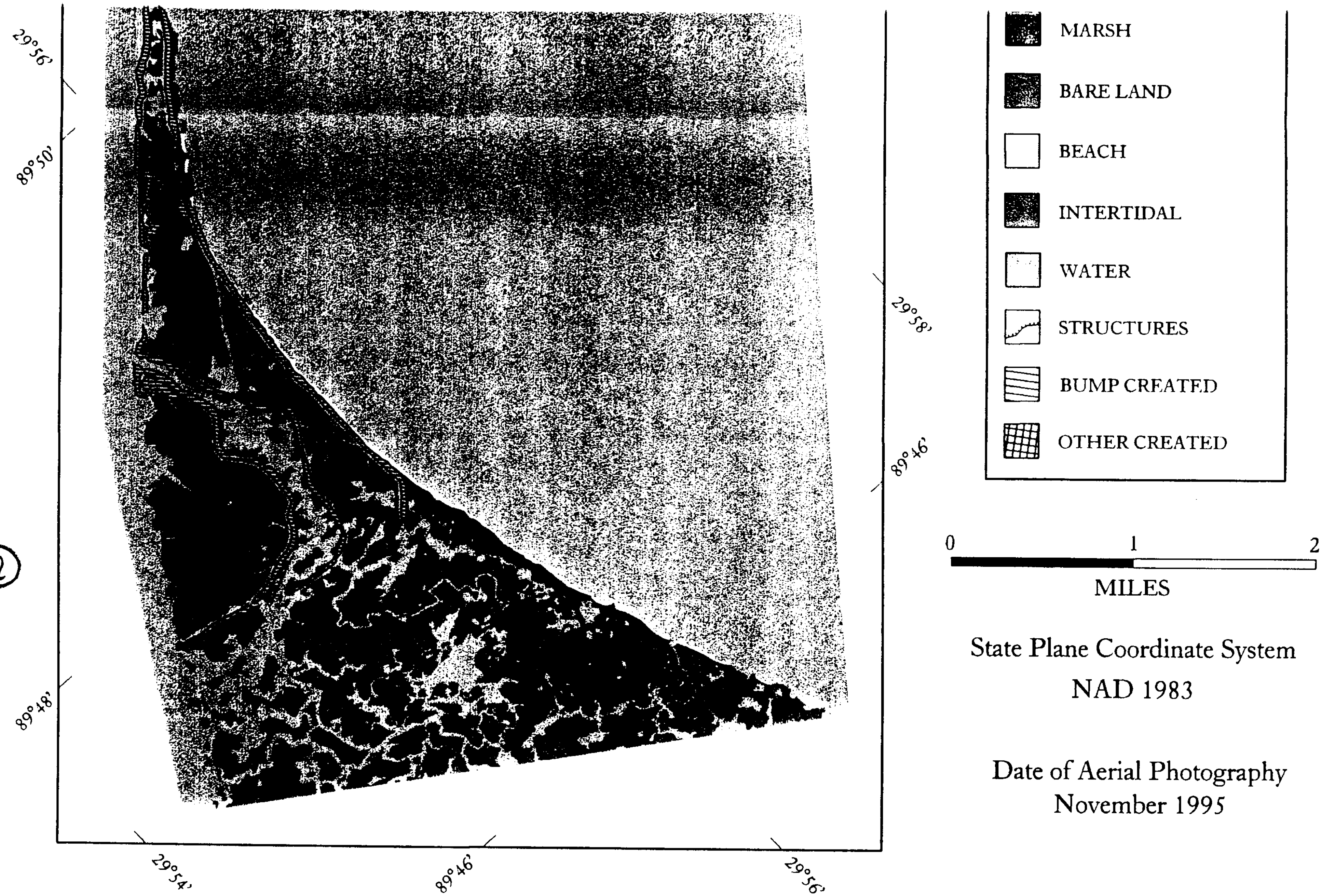
In terms of total area, marsh (2937.9 acres or 85.3%) dominated the landscape of the MRGO - Mile 47-59 BUMP study area.

TABLE 3
November 1995 Habitat Inventory of the MRGO-Mile 47-59 BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP-MADE
Marsh	2937.9	2715.2	1.2	221.5
Upland	263.6	64.6	11.6	187.4
Shrub/Scrub	91.6	42.0	38.0	11.5
Trees	19.1	0.0	17.2	0.0
Bare Land	89.4	55.2	0.9	33.3
Beach	43.1	43.1	0.0	0.0
Habitat Total	3444.7	2920.1	70.8	453.7


30°00'
89°52'
29°58'
89°52'
29°56'
89°50'
30°00'
89°48'
N
LEGEND
FORESTED WETLAND
SHRUB/SCRUB
UPLAND
MARSH
BARE LAND

①



Q

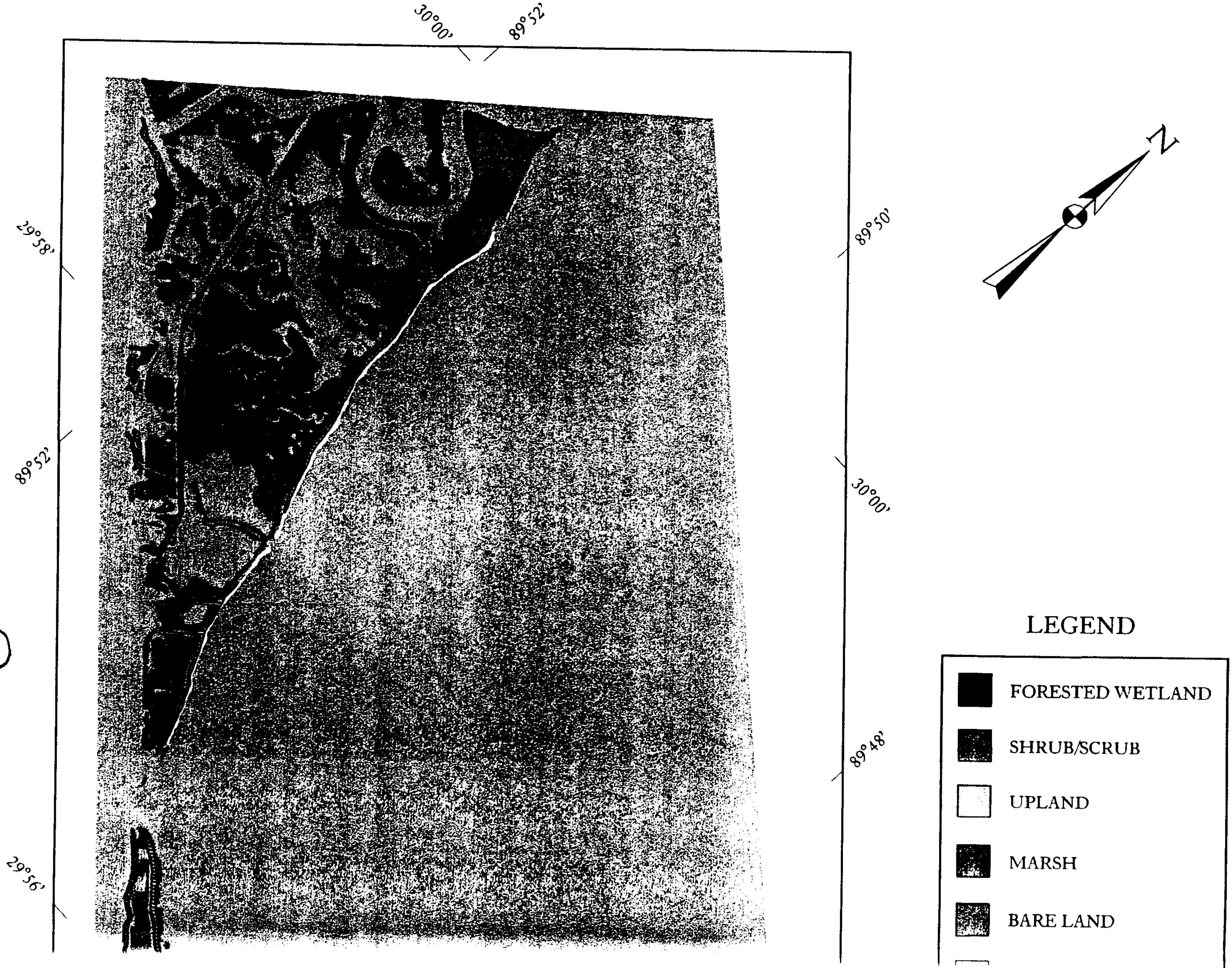
Figure 16. Habitat inventory map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area in November 1995.

Table 4 lists the areas of the five habitats found in the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area in November 1996. The location and arrangement of these habitats is presented in figure 17. In 1996, the total area of the MRGO - Mile 47-59 BUMP study area was calculated at 3463.0 acres. Of this total, 2902.8 acres were natural and 560.2 acres were man-made including 83.8 acres other-made and 476.4 BUMP-made, or 83.8 percent was natural, 2.4 percent was other-made and 13.8 percent was BUMP-made. In order of decreasing size and importance, the largest habitat found is natural marsh (2707.0 acres) followed by BUMP-made marsh (279.6 acres), other-made upland (133.8 acres), natural shrub/scrub (67.7 acres), natural beach (63.9 acres), BUMP-made shrub/scrub (48.5 acres), natural upland (47.0 acres), other-made shrub/scrub (41.8 acres), other-made upland (28.2 acres), natural bare land (17.2 acres), BUMP-made bare land (14.5 acres), other-made trees (6.6 acres), other-made bare land (5.2 acres), and other-made marsh (2.0 acres). The 1996 habitat inventory did not identify any natural or BUMP trees, other-made beach or BUMP-made beach.

In terms of total area, marsh (2988.6 acres or 86.3%) dominated the landscape of the MRGO - Mile 47-59 BUMP study area.

TABLE 4
November 1996 Habitat Inventory of the MRGO-Mile 47-59 BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP-MADE
Marsh	2988.6	2707.0	2.0	279.6
Upland	209.0	47.0	28.2	133.8
Shrub/Scrub	158.0	67.7	41.8	48.5
Trees	6.6	0.0	6.6	0.0
Bare Land	36.9	17.2	5.2	14.5
Beach	63.3	63.9	0.0	0.0
Habitat Total	3463.0	2902.8	83.8	476.4



30°00'
89°52'
29°58'
89°52'
29°56'
89°50'
30°00'
89°48'
N
LEGEND
FORESTED WETLAND
SHRUB/SCRUB
UPLAND
MARSH
BARE LAND

(1)

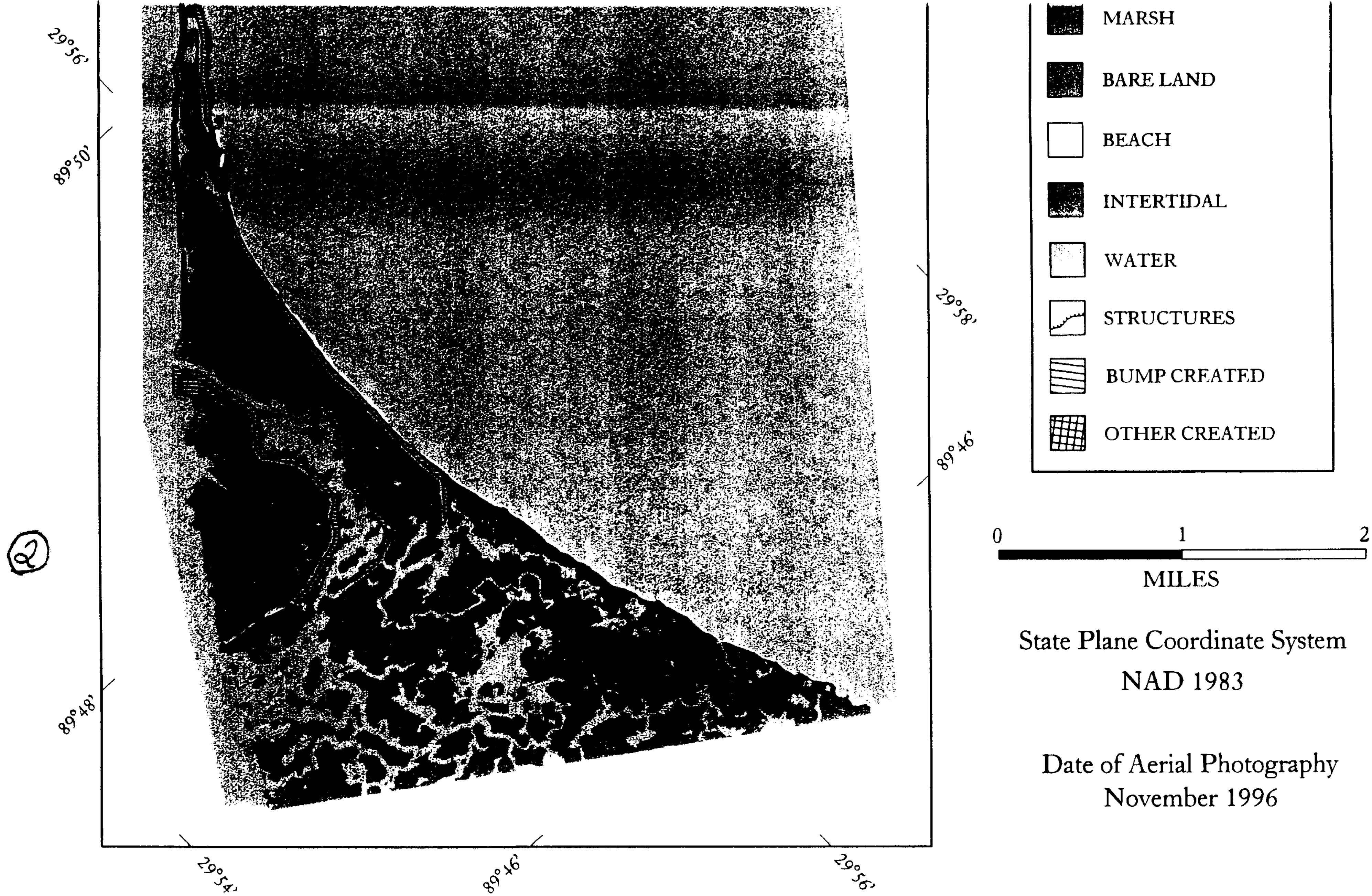


Figure 17. Habitat inventory map of the Mississippi River Gulf Outlet - Mile 47-59 BUMP study area in November 1996.

Habitat Change

Land loss dominates the natural processes of this area. The total area decreased by -155.1 acres which represents a 4 percent decrease in area between 1990 and 1996. There was an overall decrease of -645.9 acres of the natural habitats, offset by an overall 490.9 acres of increase in man-made habitats largely due to the placement of dredged materials. Table 5 lists the major habitat changes.

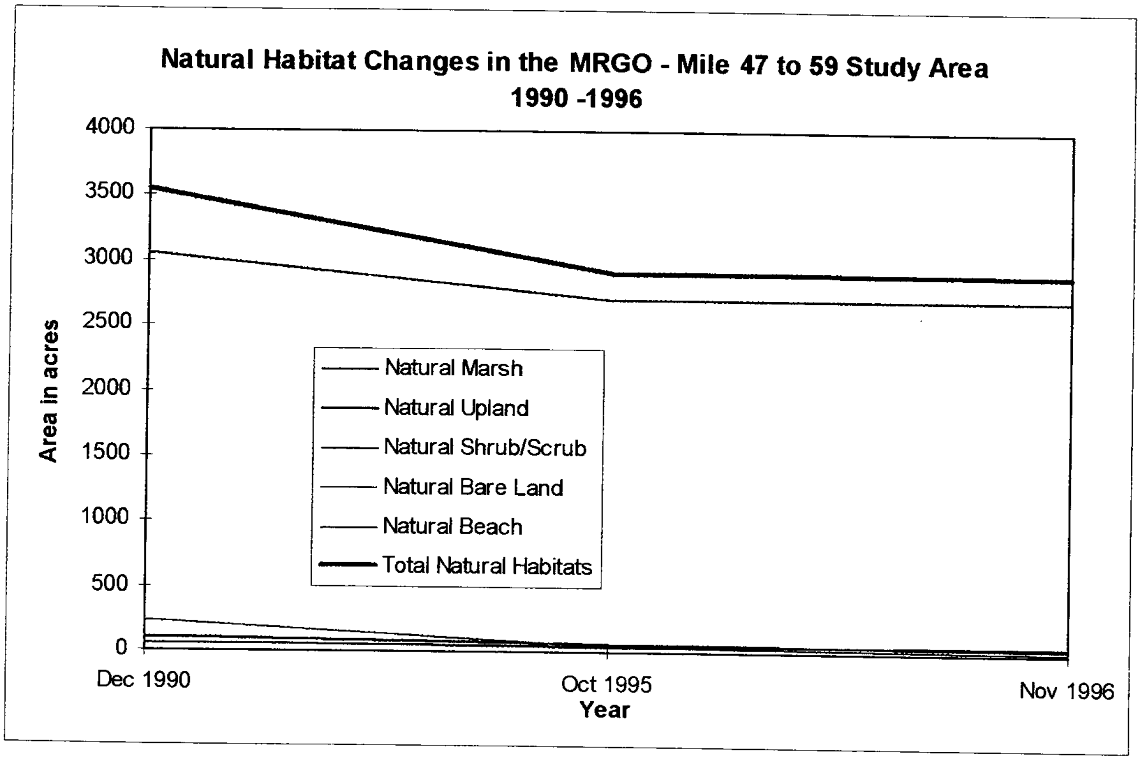
The greatest habitat change was the decrease by natural processes of natural marsh (-356.7 acres). Other large changes occurred in the BUMP-made marsh (+276.9 acres), natural bare land (-220.5 acres), BUMP-made upland (+105.0 acres), natural upland (-66.5 acres), and other-made shrub/scrub (+36.6 acres). In terms of the beneficial use process, the greatest areas of new habitat creation include BUMP-made marsh (+276.9 acres), and BUMP-made shrub/scrub (+105.0 acres). Figure 18 graphs the natural habitat changes over time. Natural marsh degradation and erosion dominates the natural habitat class.

Figure 18 shows a time series of habitat changes in the MRGO Mile 47-59 BUMP study area. Figure 18A graphs the natural habitat changes over time. Figure 18B graphs the man-made habitat changes. Figure 19 documents the creation of habitats at the MRGO-Mile 47-59 BUMP study area from December 1990 and November 1996.

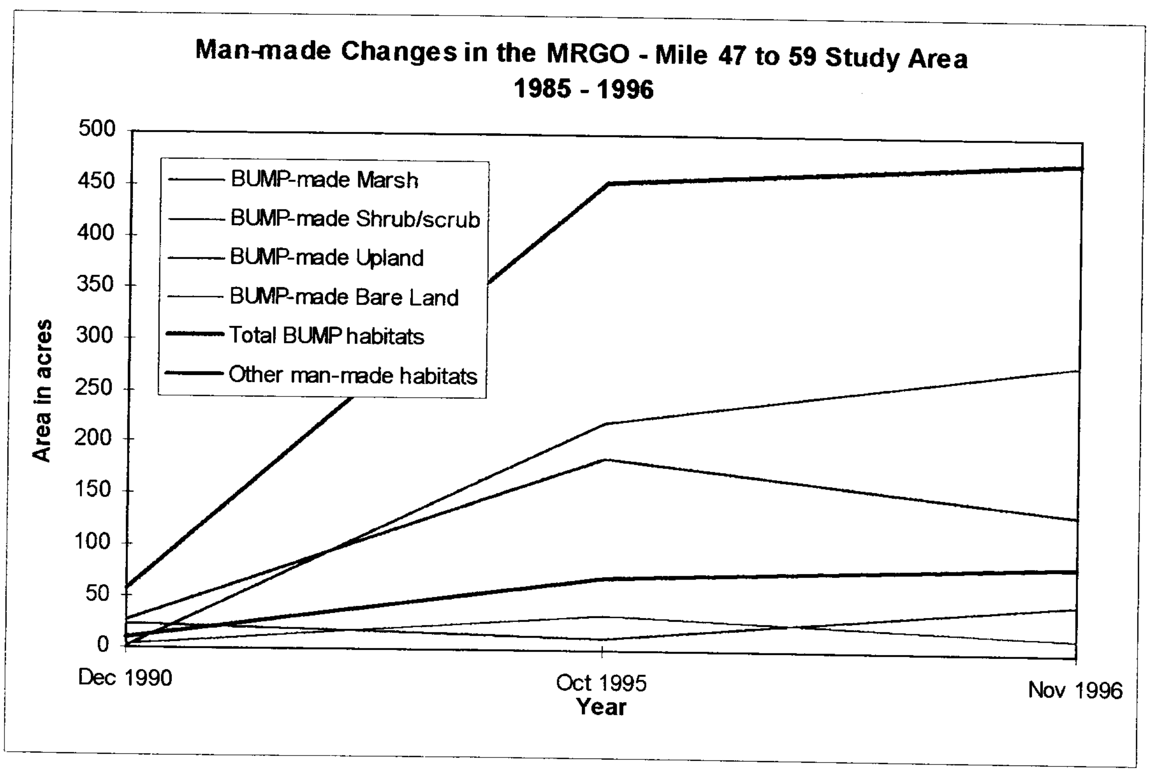
TABLE 5
Change in Total Acres of each Habitat
in the MRGO-Mile 47-59 BUMP Study Area between 1990 and 1996

HABITAT	1990-1995[1]	1995-1996[1]	1990-1996[1]
Natural Marsh	-348.5	-8.2	-356.7
Natural Upland	-48.9	-17.6	-66.5
Natural Shrub/Scrub	-26.9	+25.7	-1.2
Natural Trees	0.0	0.0	0.0
Natural Bare Land	-182.5	+38.0	-220.5
Natural Beach	-21.8	+20.8	-1.0
Total Natural Habitats	-628.6	-17.3	-645.9
BUMP Man-made Marsh	+218.8	+58.1	+276.9
BUMP Man-made Upland	+158.6	-53.6	+105.0
BUMP Man-made Shrub/Scrub	-11.8	+37.0	+25.2
BUMP Man-made Trees	0.0	0.0	0.0
BUMP Man-made Bare Land	+29.2	-18.8	+10.4
BUMP Man-made Beach	0.0	0.0	0.0
Total BUMP Man-made Habitats	+394.8	+22.7	+417.5
Other Man-made Marsh	-0.1	+0.8	+0.7
Other Man-made Upland	+8.8	+16.6	+25.4
Other Man-made Shrub/Scrub	+32.8	+3.8	+36.6
Other Trees	+18.0	-12.5	+5.5
Other Man-made Bare Land	+0.9	+4.3	+5.3
Other Man-made Beach	0.0	0.0	0.0
Total Other Man-made Habitats	+60.4	+13.0	+73.4
HABITAT TOTAL	-173.4	+18.4	-155.1

[1] in acres

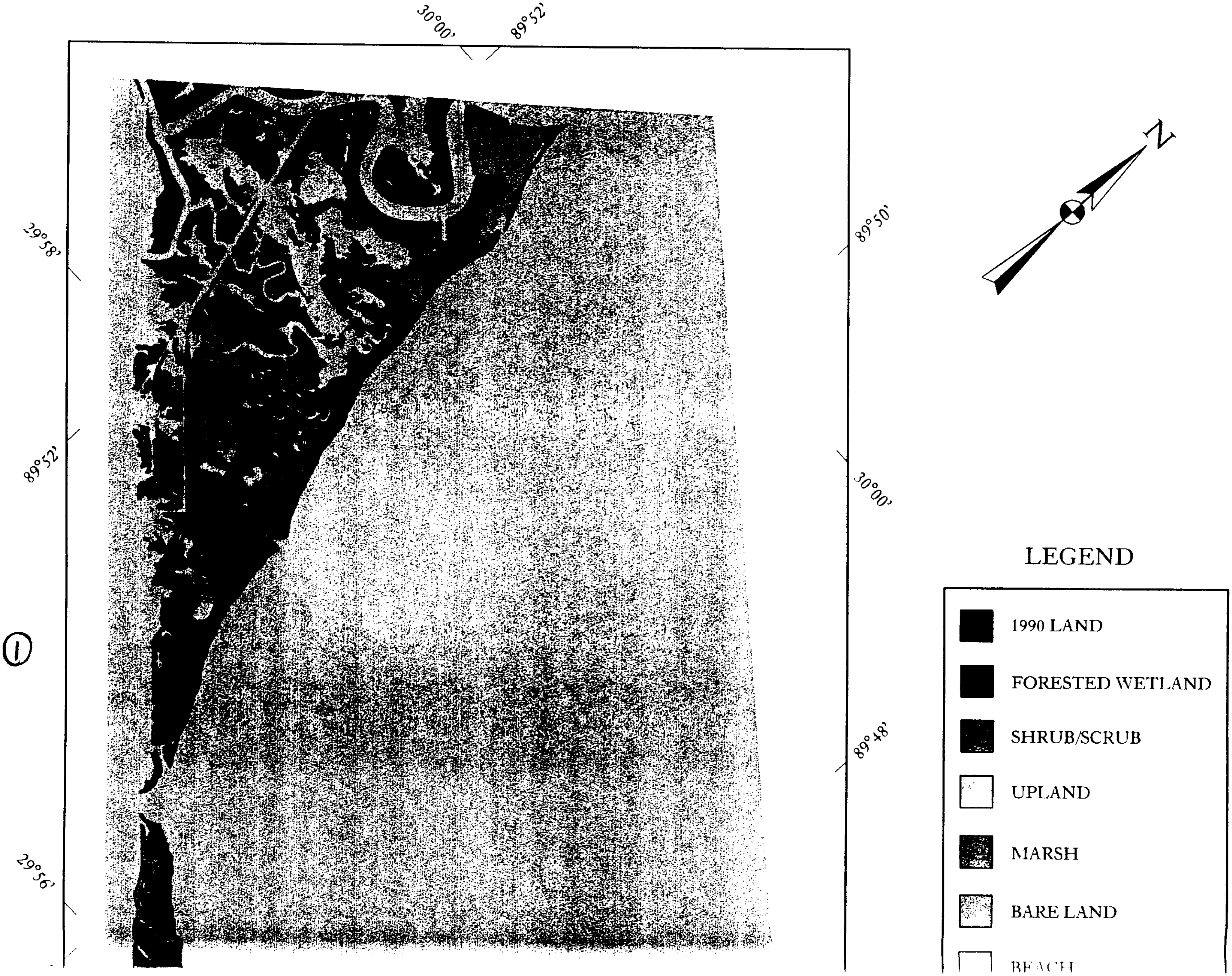


A



B

Figure 18. Time series showing the changes in total area of each habitat in the MRGO - Mile 47-59 BUMP study area between December 1990 and November 1996. A) natural habitat changes. B) man-made habitat changes.


30°00'
89°52'
29°58'
89°52'
29°56'
89°50'
30°00'
89°48'
N
LEGEND
1990 LAND
FORESTED WETLAND
SHRUB/SCRUB
UPLAND
MARSH
BARE LAND

①

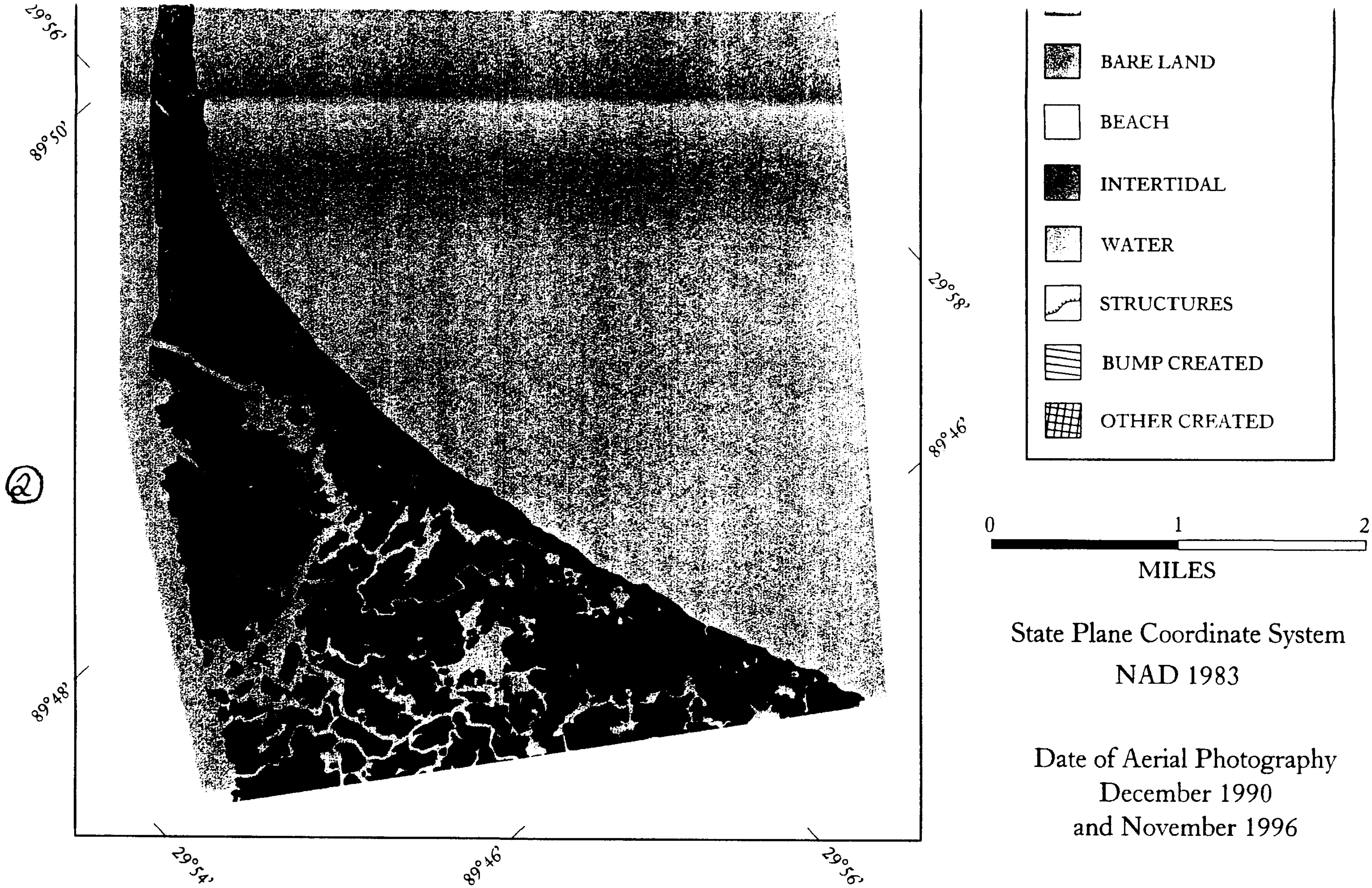


Figure 19. Map of the MRGO-Mile 47-59 BUMP study area showing the new habitats that developed between December 1990 and November 1996.

CONCLUSIONS

1. A) The total area of the MRGO - Mile 47-59 BUMP study area in December 1990 was 3618.0 acres. Natural processes accounted for 3548.7 acres or 98 percent of the total area. Man-made processes related to beneficial use of dredged material accounted for 58.9 acres or 1.6 percent of the total area.
   B) The total area of the MRGO - Mile 47-59 BUMP study area in November 1995 was 3444.7 acres. Natural processes accounted for 2920.1 acres or 85 percent of the total area. Man-made processes related to the beneficial use of dredged material accounted for 453.7 acres or 13 percent of the total area.
   C) The total area of the MRGO - Mile 47-59 BUMP study area in November 1996 was 3463.0 acres. Natural processes accounted for 2902.8 acres or 84 percent of the total area. Man-made processes related to the beneficial use of dredged material accounted for 476.4 acres or 14 percent of the total area.

2. A) The MRGO - Mile 47-59 BUMP study area decreased by 173.4 acres between December 1990 and November 1995. Natural processes were responsible for -628.6 acres of decrease and the beneficial use of dredged material was responsible for +394.8 acres of increase.
   B) The MRGO - Mile 47-59 BUMP study area increased by +18.4 acres between November 1995 and November 1996. Natural processes were responsible for 17.3 acres of decrease and the beneficial use of dredged material was responsible for +22.7 acres of increase.
   C) The MRGO - Mile 47-59 BUMP study area decreased by -155.1 acres between December 1990 and November 1996. Natural processes were responsible for -645.9 acres of decrease and the beneficial use of dredged material was responsible for +417.9 acres of increase.

3. Natural processes are responsible for eroding the marsh at a rate of -59.5 acres per year. Beneficial use of dredged material appears to be effective in nourishing and restoring marsh habitats.

4. The field surveys indicate the correct stacking heights are optimal for creating marsh and to a lesser extent shrub/scrub. The optimal elevation for marsh creation appears to be less than +2 feet MSL (+2.78 feet MLG). Initial stacking heights were reported to be +3.5 MLG from "As-builts" which resulted in appropriate height presently for healthy marsh growth.

5. At the MRGO - Mile 47-59 BUMP study area, the beneficial use of dredged material created +417.5 acres of new habitat between December 1990 and November 1996. This total includes: +276.9 acres of marsh, +105.0 acres of upland, 25.2 acres of shrub/scrub, and +10.4 acres of bare land.

6. Within the MRGO - Mile 47-59 BUMP study area, the beneficial use of dredged material reduced the amount of coastal land loss by 65 percent.

7. Retaining dikes need to be maintained in place until material within them has consolidated enough to withstand tidal movement.

APPENDIX 2A

LIST OF VEGETATIVE SPECIES IN THE MISSISSIPPI RIVER GULF OUTLET - MILE 47-59

LIST OF VEGETATIVE SPECIES
IN THE MISSISSIPPI RIVER GULF OUTLET - MILE 47-59

An alphabetical list of observed and collected plant species follows. This list is not complete, but is meant to establish vegetative character and indicate dominant species observed. The list includes the species name, alternate scientific names, common names, and general habitat description for each plant. The habitat information was taken from the Manual of the Vascular Flora of the Carolinas or The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts.

Aster tenuifolius L. . . . . Salt marsh aster
Herbaceous perennial; brackish marshes

Avicennia germinans L. . . . . Black mangrove
evergreen shrub; sandy and silty shores in salt and brackis water, upper tidal zone of saline marshes

Baccharis halimifolia L. . . . . Groundselbush
shrub; elevated sites in fresh to saline marshes

Bacopa monnieri (L.) Pennell. . . . . Smooth Water-hyssop
Succulent, creeping herb; sandy margins of fresh or brackish marshes, streams and ponds

Borrichia frutescens (L.) . . . . sea ox-eye
rhizomatous shrub; brackish marsh or upper zones of salt marsh

Distichlis spicata (L.) Greene . . . . salt grass
rhizomatous perennial; brackish marshes and flats

Eleocharis parvula L. . . . . Spikerush
small dense, rhizomatous perennial; brackish marshes, rarely fresh-water marshes

Iva frutescens L. . . . . marsh elder
shrub; brackish marshes, upper zones of salt marsh

Scirpus robustus L. . . . . Saltmarsh Bulrush
coarse perennial; brackish marshes and ditches, higher parts of salt or brackish marshes

Spartina alterniflora Loisel. . . . . oyster grass
rhizomatous perennial; salt and brackish marshes

Spartina cynosuroides (L.) Roth . . . . Big cordgrass
coarse perennial; Brackish or freshwater tidal marshes, brackish sloughs

Spartina patens L. . . . . Marshhaycordgrass
rhizomatous perennial; brackish marshes, low dunes and backbarrier samd flats

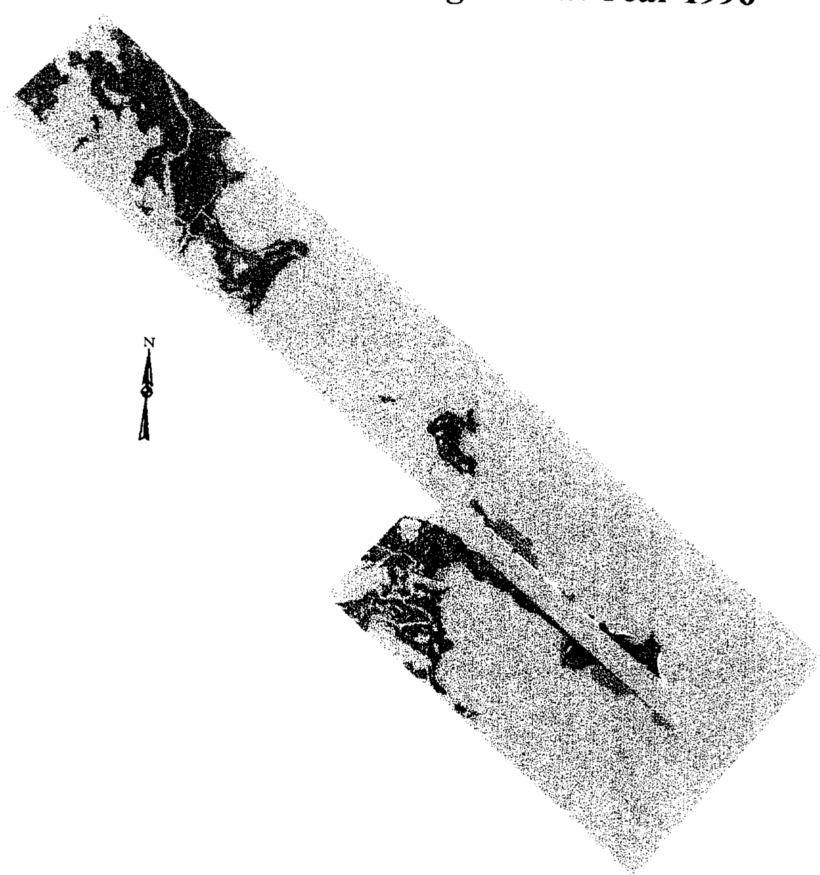
Solidago sempervirens L. . . . . Seaside Goldenrod
Herbaceous perennial; elevated sites in brackish or saline marshes, bay shores, swales, overwash areas, mini-dunes

U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties

Base Year 1985 through Fiscal Year 1996



Shea Penland, Karen A. Westphal, Qiang Tao, Chris Zganjar, Jamie Phillippe, and Paul Connor
Louisiana State University - Coastal Studies Institute
Baton Rouge, LA 70803

and

Linda Mathies, Beth Nord, and Robert Gunn
Operations Division - Technical Support Branch (CELMN-OD-T)
U.S. Army Corps of Engineers - New Orleans District
New Orleans, LA 70160-0267

Baton Rouge, Louisiana
1997

TABLE OF CONTENTS

INTRODUCTION 3-1

DREDGED MATERIAL DISPOSAL HISTORY: 1985 -1996 3-4

FIELD SURVEY RESULTS 3-6
- Methodology 3-6
  - Elevation Profile Surveys 3-6
    - Vegetation Surveys 3-8
- Profiles 3-8
- Vegetative Character 3-12
  - General Description 3-12
  - Vegetative community types 3-12

GIS ANALYSIS RESULTS 3-13
- Shoreline Changes: 1985-1996 3-13
- Habitat Inventory 3-16
- Habitat Change 3-24

CONCLUSIONS 3-28

APPENDIX 3A 3A-1

LIST OF FIGURES

Figure 1. The location of the Mississippi River Gulf Outlet, Louisiana - Jetties BUMP study area in Louisiana. 3-1

Figure 2. Location of the Mississippi River Gulf Outlet - Jetties BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized. 3-3

Figure 3. The dredged material disposal history for the Mississippi River Gulf Outlet - Jetties BUMP study area before November 1996. 3-5

Figure 4. Location of the MRGO - Jetties BUMP study area profile transects and the benchmark available to reference the elevation data. A) The peninsula B) In-filled pipelines. 3-7

Figure 5. A comparison between 1995 and 1996 data for the strike profile at stake 1.0 (A-A') at MRGO Jetties peninsula showing colonization of vegetation over a one-year period. A) 1995 elevation and vegetation data. B) 1996 elevation and vegetation data. 3-9

Figure 6. A comparison between 1995 and 1996 data for the dip profile at stake 2.0 (B-B') at MRGO Jetties peninsula showing colonization of vegetation over a one-year period. A) 1995 elevation and vegetation data. B) 1996 elevation and vegetation data. 3-10

Figure 7. 1996 Elevation profile of MRGO-Jetties Pipeline near Bayou Pointe en Pointe with vegetation data illustrated. 3-11

Figure 8. Graph of the area of the Mississippi River Gulf Outlet - Jetties BUMP study area over time, with and without the placement of dredged material. 3-14

Figure 9. Shoreline changes of the Mississippi River Gulf Outlet - Jetties BUMP study area between December 1985 and November 1996. 3-15

Figure 10. Habitat inventory map of the Mississippi River Gulf Outlet - Jetties BUMP study area in December 1985. 3-17

Figure 11. Habitat inventory map of the Mississippi River Gulf Outlet - Jetties BUMP study area in February 1995. 3-19

Figure 12. Habitat inventory map of the Mississippi River Gulf Outlet - Jetties BUMP study area in November 1995. 3-21

Figure 13. Habitat inventory map of the Mississippi River Gulf Outlet - Jetties BUMP study area in November 1996. 3-23

Figure 14. Map of the Mississippi River Gulf Outlet - Jetties BUMP study area showing the new habitats created by beneficial use of dredged materials or formed by natural processes between December 1985 and November 1996.. 3-25

Figure 15. Time series showing the changes in total area of each habitat in the MRGO - Jetties BUMP study area between December 1985 and November 1996. A) natural habitat changes. B) man-made habitat changes. 3-27

LIST OF TABLES

TABLE 1
MRGO- Jetties Area: 1985-1996 3-14

TABLE 2
December 1985 Habitat Inventory of the MRGO-Jetties BUMP Study Area 3-16

TABLE 3
February 1995 Habitat Inventory of the MRGO-Jetties BUMP Study Area 3-18

TABLE 4
November 1995 Habitat Inventory of the MRGO-Jetties BUMP Study Area 3-20

TABLE 5
November 1996 Habitat Inventory of the MRGO-Jetties BUMP Study Area 3-22

TABLE 6
Change in Total Acres of each Habitat in the MRGO-Jetties BUMP Study Area between 1985 and 1996 3-26

INTRODUCTION

The Mississippi River Gulf Outlet (MRGO) navigation channel - jetties study area is located 30 miles southeast of New Orleans between MRGO Mile 18 and Mile 30 (Figure 1). The U.S. Army Corps of Engineers - New Orleans District (USACE-NOD) maintains this navigation channel through the abandoned St. Bernard delta complex. Because the St. Bernard delta complex is abandoned, it is experiencing rapid coastal erosion and wetland loss.

The Beneficial Use of dredged material Monitoring Program (BUMP) at Louisiana State University - Coastal Studies Institute (LSU-CSI) is documenting the beneficial use of dredged material using aerial photography, geographical information system (GIS) analysis, and field surveys through the sponsorship of the USACE-NOD. BUMP results are provided in map series, annual reports, and scientific literature.

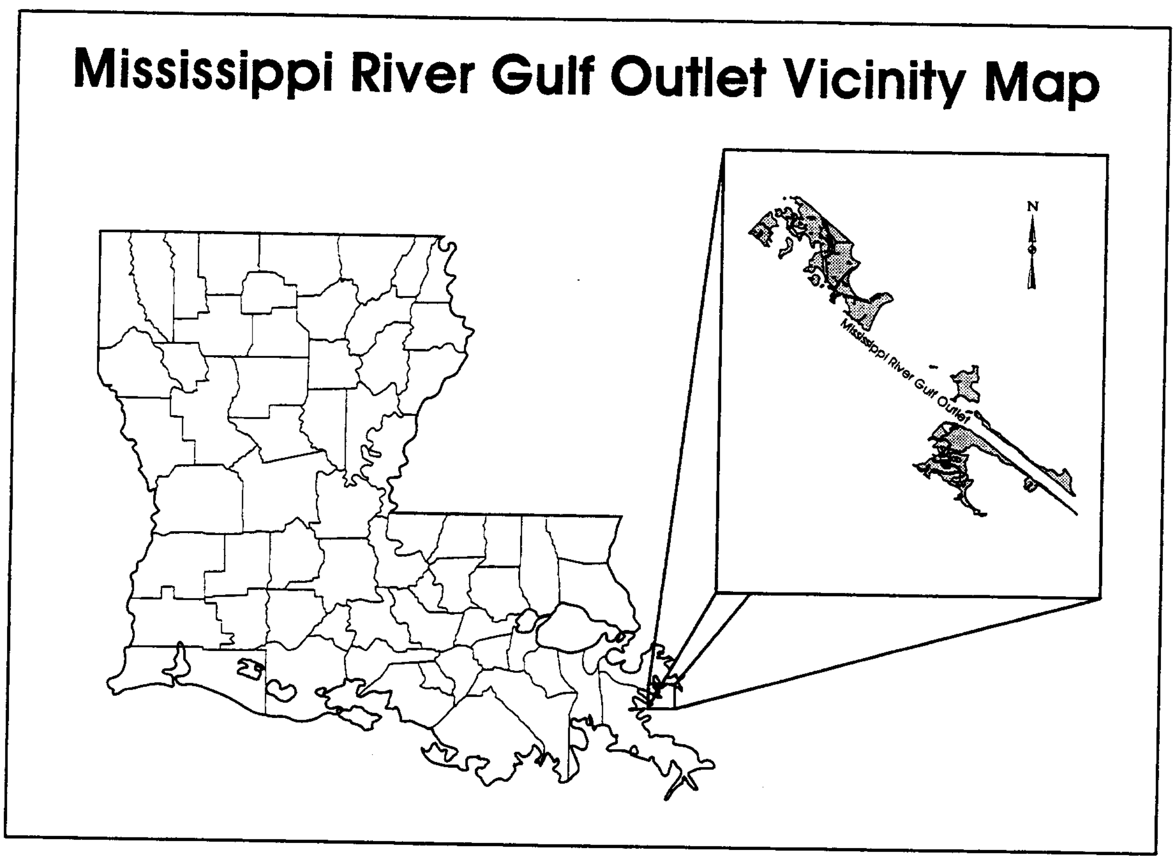


Figure 1. The location of the Mississippi River Gulf Outlet, Louisiana - Jetties BUMP study area in Louisiana.

In this report, LSU presents the results of the BUMP analysis at the Mississippi River Gulf Outlet navigation channel - jetties study area, representing monitoring results through the USACE-NOD Fiscal Year 1996. This is the third part of the six part Beneficial Use of dredged material Monitoring Program (BUMP), 1996 Final Report. The nine parts are:

- Part 1: Introduction and Methodology
- Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
- Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
- Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
- Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
- Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass
- Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Canal, Louisiana - Bay Chaland
- Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe
- Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Using aerial photography LSU classified the natural and man-made habitats in the study area for December 1985, February 1995, November 1995, and November 1996 including habitat created during the USACE-NOD FY1996 maintenance event. There was no maintenance dredging between Mile 18 and 30 during FY94. Through the GIS analysis, these areas were calculated and changes documented between 1985, 1995 and 1996. Field surveys were conducted on the beneficial use area created during the Fiscal Year 1992 and FY1993, and the FY96 maintenance events. Habitats were ground truthed and survey transects established to document vegetation species, stacking elevations, and subsidence. Figure 2 shows the areas of minimum air photo mosaic coverage and the limit of the digitized area.

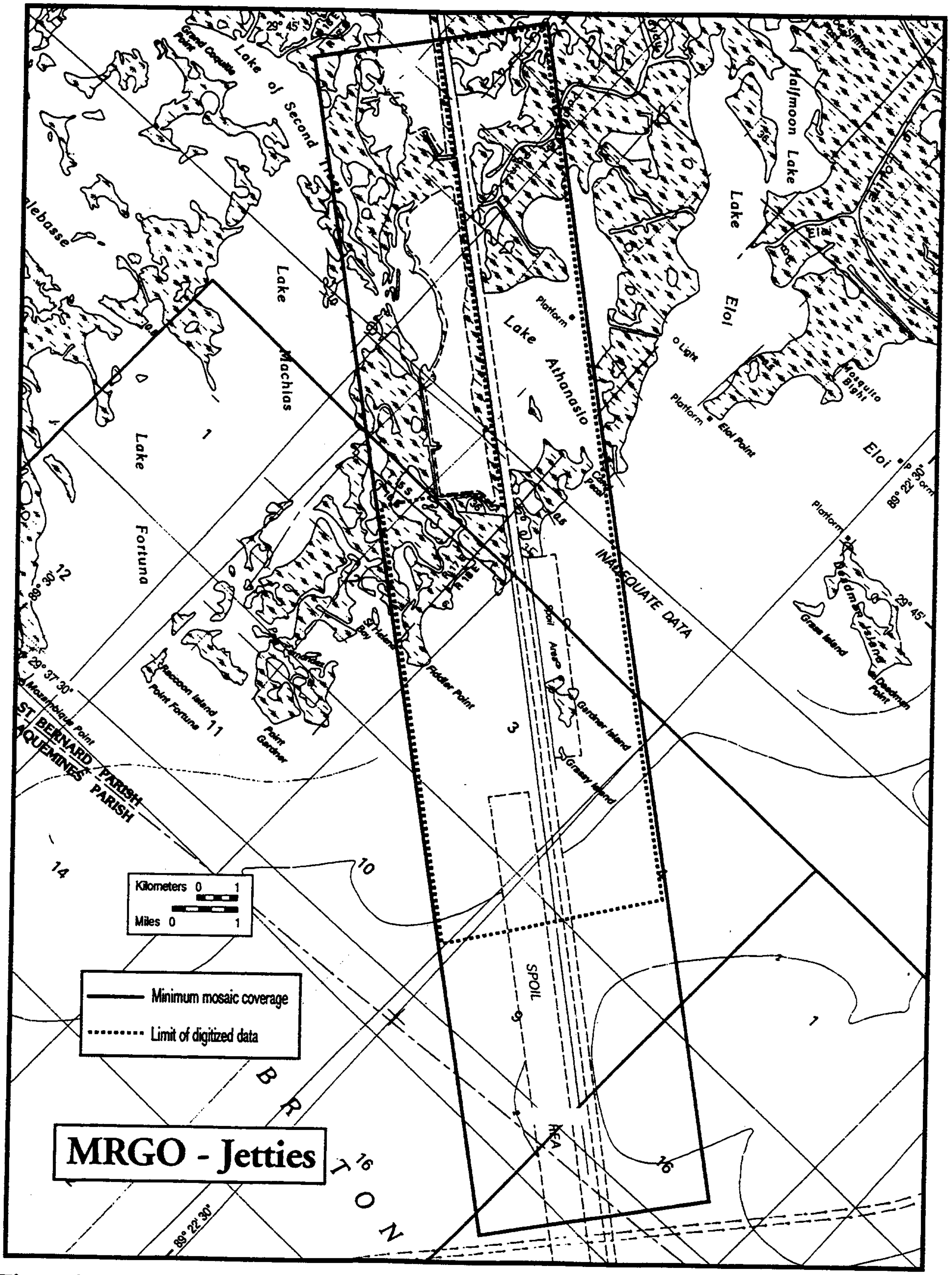


Figure 2. Location of the Mississippi River Gulf Outlet - Jetties BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized.

DREDGED MATERIAL DISPOSAL HISTORY: 1985 -1996

The Rivers and Harbors Act of 1956 authorized the USACE-NOD to construct and maintain a deep draft navigation channel 36 feet deep by 500 feet wide from the Inner Harbor Navigation Canal in New Orleans to the Chandeleur Islands (Mile 66.0 to Mile 0) and a channel 38 feet deep by 600 feet wide from the islands to the 38 foot contour in the Gulf of Mexico (Mile 0 to Mile -9.0). Construction of the Mississippi River - Gulf Outlet (MRGO), Louisiana, navigation channel was initiated in 1958 and enlargement to full project dimensions was completed in 1968. Maintenance of discontinuous reaches of the channel has been accomplished on an annual basis since construction was completed.

Prior to and including the USACE-NOD Fiscal Year 1988 maintenance event, dredged material removed from the Mile 27.0 to Mile 32.1 reach of the channel was placed into an existing confined disposal facility located on the south bank of the navigation channel (Figure 3). Dredged material from the Mile 23.1 to Mile 15 reach of the channel was placed unconfined in shallow, open water adjacent to the south jetty for wetland creation. The initial height of the dredged material placed for wetland creation adjacent to the south jetty was +3.0 feet Mean Low Gulf (MLG) (+2.22 National Geodetic Vertical Datum (NGVD)).

During the FY 1991 maintenance event, dredged material from Mile 21.4 to Mile 15.3 reach was placed adjacent to the south jetty for wetland creation.

In FY 1992, dredged material from the Mile 27.0 to Mile 23.1 reach was placed into existing oil exploration canals and into shallow open water adjacent to the north jetty for wetland creation. The initial height of the dredged material placed into the canals was +3.5 feet MLG (+2.72 feet NGVD) and the initial height of the material placed adjacent to the north jetty was +5.78 feet MLG (+5.0 feet NGVD).

During the FY 1993 maintenance event, dredged material from the Mile 23.0 to Mile 22.5 reach was placed adjacent to the north jetty for wetland creation and material from the Mile 20 to Mile 15.3 reach was placed adjacent to the south jetty for wetland creation. Dredged material from the Mile 22.5 to Mile 20.5 reach was placed adjacent to the south jetty to begin construction of an *interior barrier island* perpendicular to the jetty. The initial height of the material for *barrier island* construction was +4.5 feet MLG (3.72 feet NGVD).

There was no maintenance dredging in the Mile 30 to Mile 18 reach of the navigation channel during FY 1994. However there was unconfined disposal at Mile 7, 9, 11, and 13 which remained intertidal. Figure 3 illustrates the dredged material disposal history for the MRGO-jetties BUMP study area prior to February 1995.

During the FY 1995 maintenance event, dredged material from the Mile 18.0 to mile 15.3 reach was placed adjacent to the south jetty, and at Mile 15 into a single point discharge area. Two pipelines near Mile 27-28 were in-filled.

During the FY 1996 maintenance event, dredged material was placed at Mile 21 adjacent to the *interior barrier island* created in FY 93, at Mile 20.3, and at Mile 19.5.

Mississippi River Gulf Outlet Disposal History

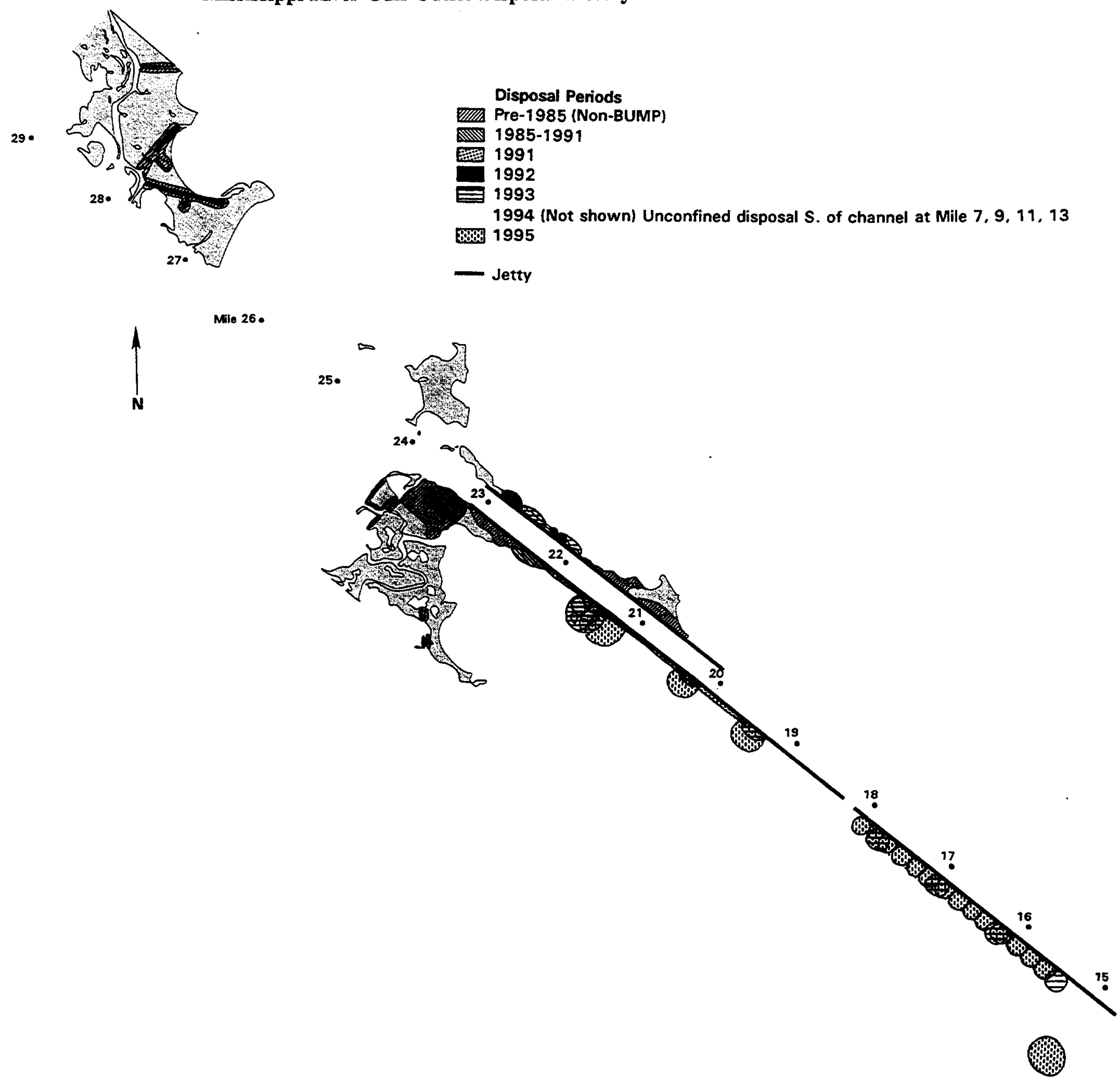


Figure 3. The dredged material disposal history for the Mississippi River Gulf Outlet - Jetties BUMP study area before November 1996.

FIELD SURVEY RESULTS

Methodology

Elevation Profile Surveys

The MRGO - Jetties study area is located where the MRGO leaves the St. Bernard marshes and enters Breton Sound. A peninsula was created by the USACE-NOD at Mile 21.5 along the south jetty during the FY1993 maintenance event representing the initial phase of *interior barrier island* construction. Two pipelines were in-filled during the FY95 maintenance event and one of these was added to the 1996 BUMP field monitoring program (Figure 4).

The collection of survey profiles was made in two phases. Phase-I involved assessing the characteristics of the area to determine the most applicable position to setup a long-term monitoring. This was accomplished using vertical aerial photography, reviewing dredging schedules and history, ground truthing the study area, and defining varying vegetation and peninsula morphology. Based on these factors, in May 1995 two transect lines were positioned along the peninsula, and three stakes, 33 feet apart, were permanently placed to represent the two profile transects. Stakes 1-0 and 2-0 represent the longitudinal profile (A-A'), and stakes 1-0 and 3-0 represent the lateral profile (B-B'). In Nov 1996, one transect was positioned across one of the in-filled pipelines, and two stakes, 30 feet apart, were placed to define the orientation of the transect (C-C'). Permanent 1-inch diameter by 6-foot galvanized stakes were driven approximately 3.5 feet into the ground and secured with concrete. The position of the stakes were determined using a Global Positioning System (GPS). Temporary white, ten-foot PVC poles with flagging and neon orange paint were slipped over the galvanized stakes to make profile siting and re-location easier.

Phase-II involved the actual collection of profile datum. In May 1995 and in June 1996, profile surveys were conducted along the transects defined by the stakes during phase-I. One longitudinal (perpendicular to jetty) profile and one lateral (parallel to jetty) profile transect were collected from MRGO- Jetties area. In November 1996, another profile was established across a pipeline. Survey datum and profiles were collected using a Topcon GTS-300$_{DPG}$ Total-Station, tri-prism, and TDS48 Data Collection System. Horizontal accuracy of the GTS-300 is 0.25 ft ± 0.0125 ft., with a vertical accuracy of 0.45 ft ± 0.0125 ft. The maximum horizontal range with tri-prism is 3,525 ft. A Pathfinder Professional MC-5 global positioning system (GPS) device was used to record the horizontal positions of each stake, instrument location, and the position and exact orientation of each transect line. The transect datum collected were processed, referenced to local benchmarks or tide gage, and entered into a graphic software program to produce topographic profiles.

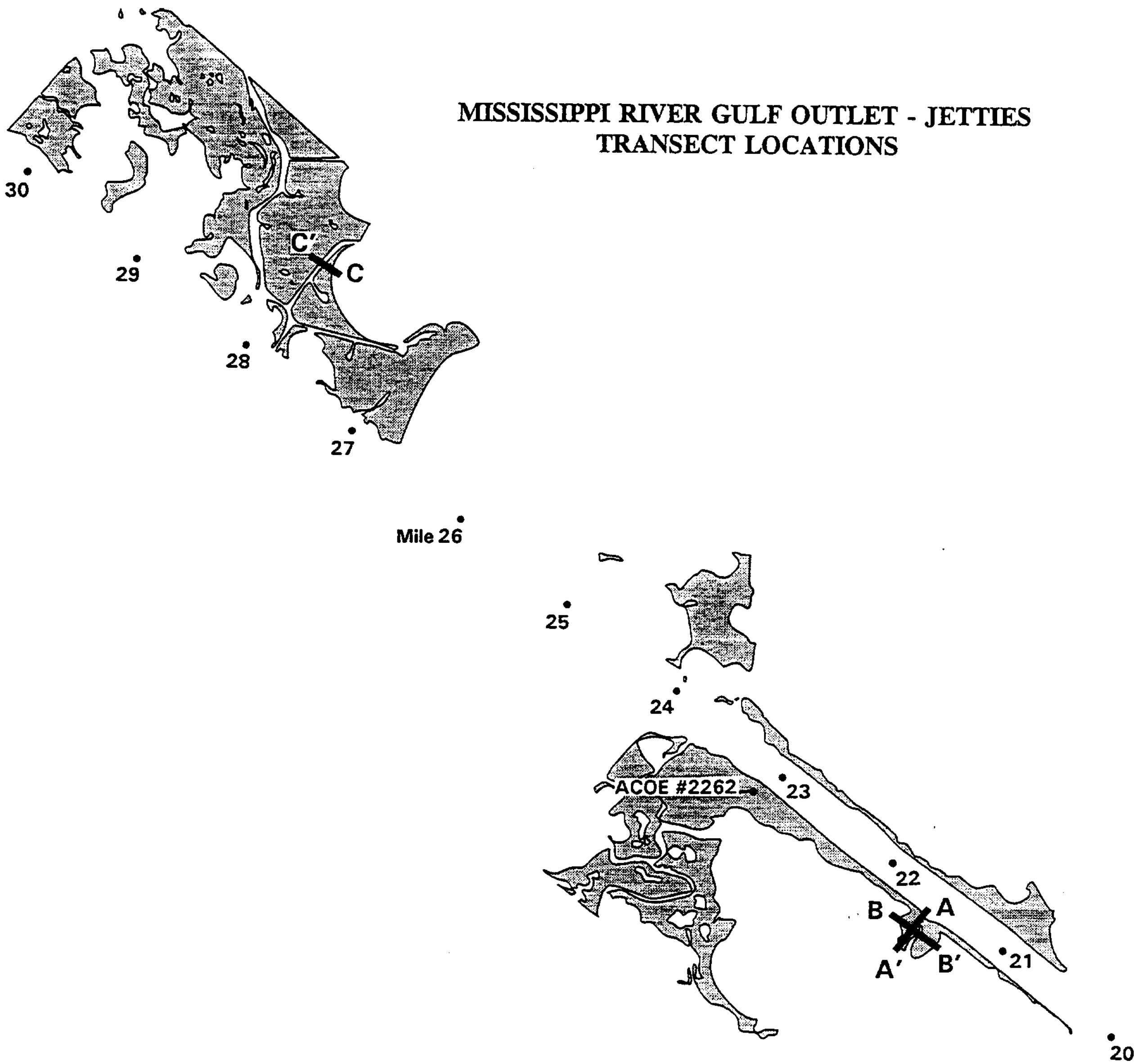


Figure 4. Location of the MRGO - Jetties BUMP study area profile transects and the benchmark available to reference the elevation data. A) The peninsula B) In-filled pipelines.

Vegetation Surveys

Ground truthing for vegetative species composition and habitat verification was done in May 1995 and June 1996 on the peninsula, and in November 1996 for the pipeline,. Species composition was determined within an approximate six-foot swath along each transect. No submerged aquatic species were considered for this report. Plants were identified in the field with only representative specimens taken for confirmation by taxonomic keys and/or verification by the LSU Department of Plant Biology. The better specimens and uncommon specimens were entered into the LSU herbarium collection; all others were archived by the author. The percent composition of each species was visually estimated in order to determine the relative abundance and dominance of species for habitat determinations. These percentages were not intended to provide scientific ratios or statistics. The species list included in Appendix 3A of this report is not complete; it reflects only those species that were readily observed during the profiling period. Some plants can only be identified during a short flowering period which may not have coincided with the time of the profile collection or ground truthing, and therefore can not be included in the list other than by a broad classification.

Profiles

Elevation data and vegetation data were acquired initially on the peninsula in May 1995, and were re-visited with new data collected in June 1996. The pipeline site was established and initial data acquired in November 1996. The MRGO - Jetties topographic profiles for the peninsula were constructed in reference to the U. S. Army Corps of Engineers benchmark #2262 (Figure 4) and the pipeline transect was constructed in reference to the Shell Beach- Lake Borgne Tide Gage. The mean diurnal tidal range for the MRGO - Jetties BUMP study area is published as 1.3 ft.

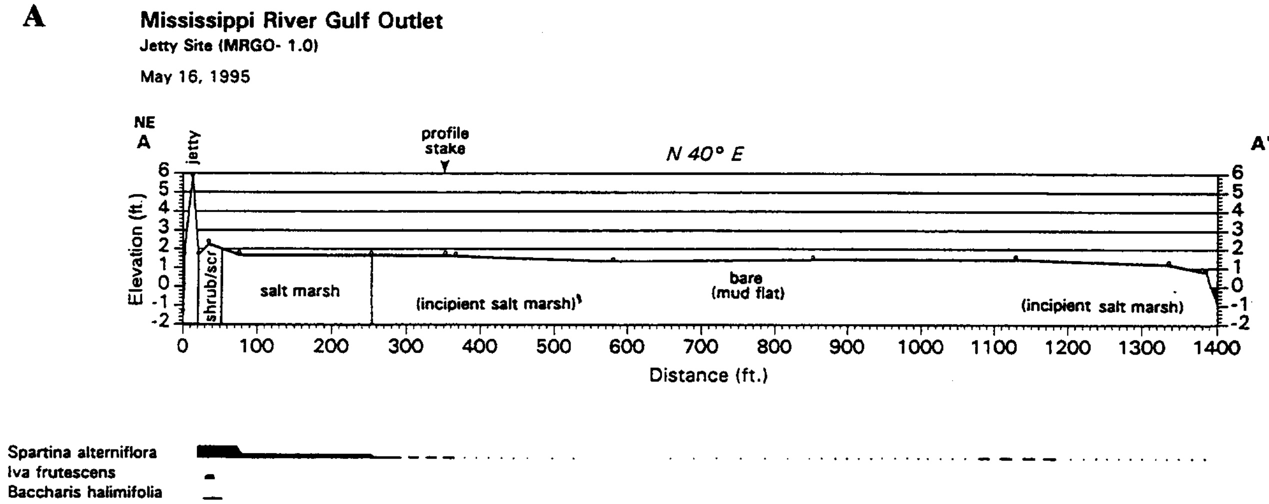
MRGO Jetties Peninsula

Figure 5 compares profile data at A-A' for 1995 and 1996. In May 1995, profiles here ranged in length from 1380 to 1500-feet. Maximum relief along profile A-A' was 2.26 feet, with an average relief of 1.66 feet. In June 1996, profiles ranged in length from 1600 to 1800 feet. Maximum relief along profile A-A' was 2.5 feet, with an average relief of 1.36 feet. In June 1996, the vegetation that had begun colonizing in 1995 was well established and had become a lush, healthy saltmarsh in 1996. A comparison of the 1995 and 1996 field surveys indicated this area had subsided -0.63 feet.

Figure 6 compares profile data at B-B' for 1995 and 1996. Profile B-B' exhibited a maximum relief of 1.67 feet, with an average relief of 1.41 feet. Profile B-B' exhibited a maximum relief of 1.71 feet, with an average relief of 1.34 feet.

The peninsula was characteristically defined as a low relief tidal flat well colonized by saltmarsh. The surficial sedimentology of the peninsula is composed of tidalite type sediments (silty clays, with very fine quartz sand). The tidal amplitude of the area was defined by the evidence of tidal pools, mud crack polygons, and vegetation distribution.

A



B

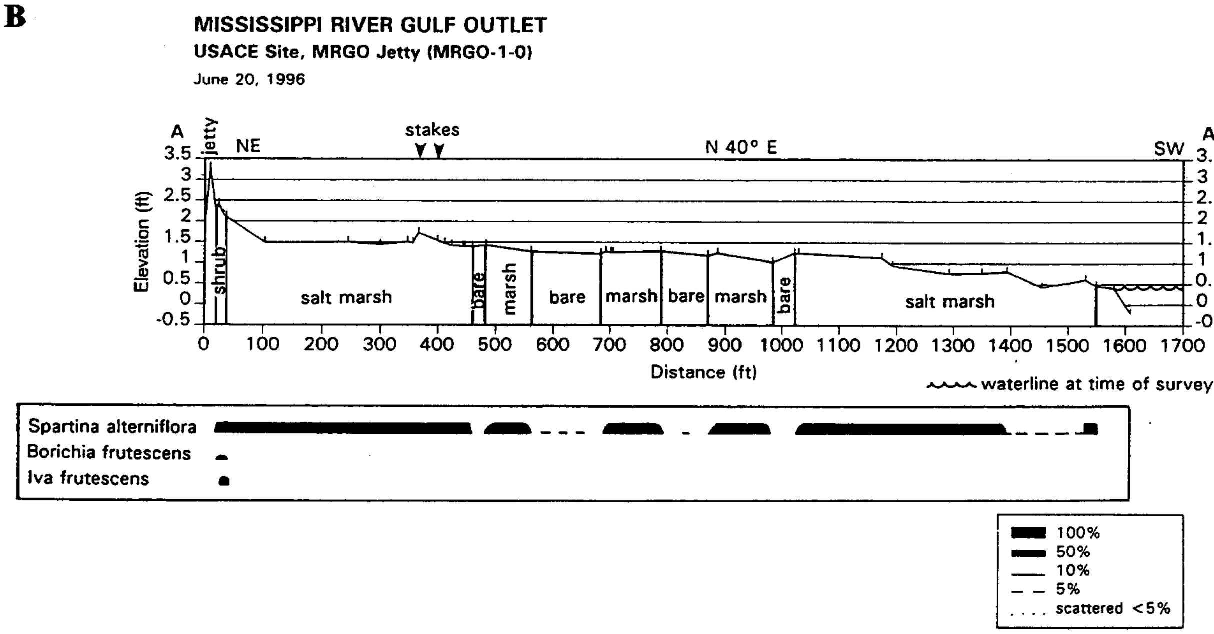
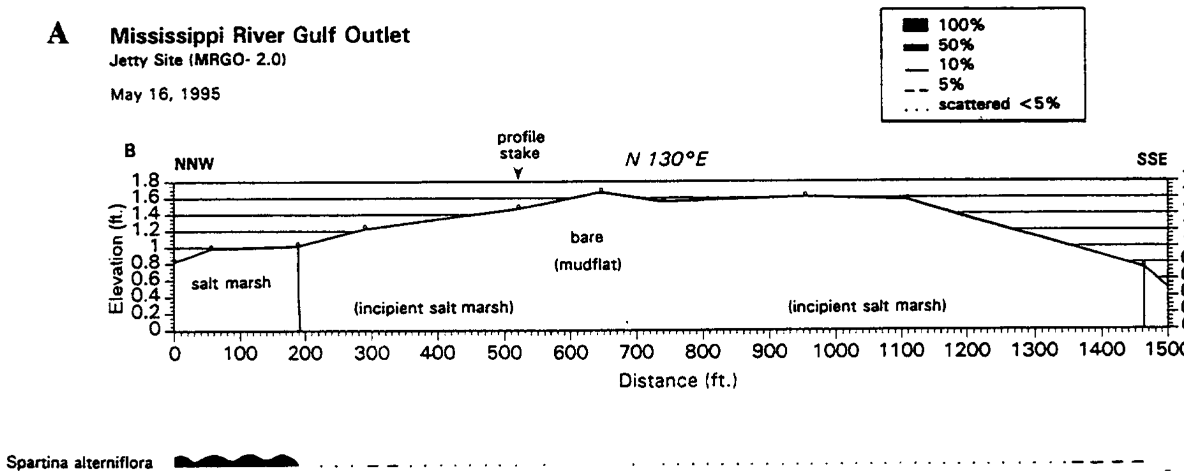


Figure 5. A comparison between 1995 and 1996 data for the strike profile at stake 1.0 (A-A') at MRGO Jetties peninsula showing colonization of vegetation over a one-year period. A) 1995 elevation and vegetation data. B) 1996 elevation and vegetation data.



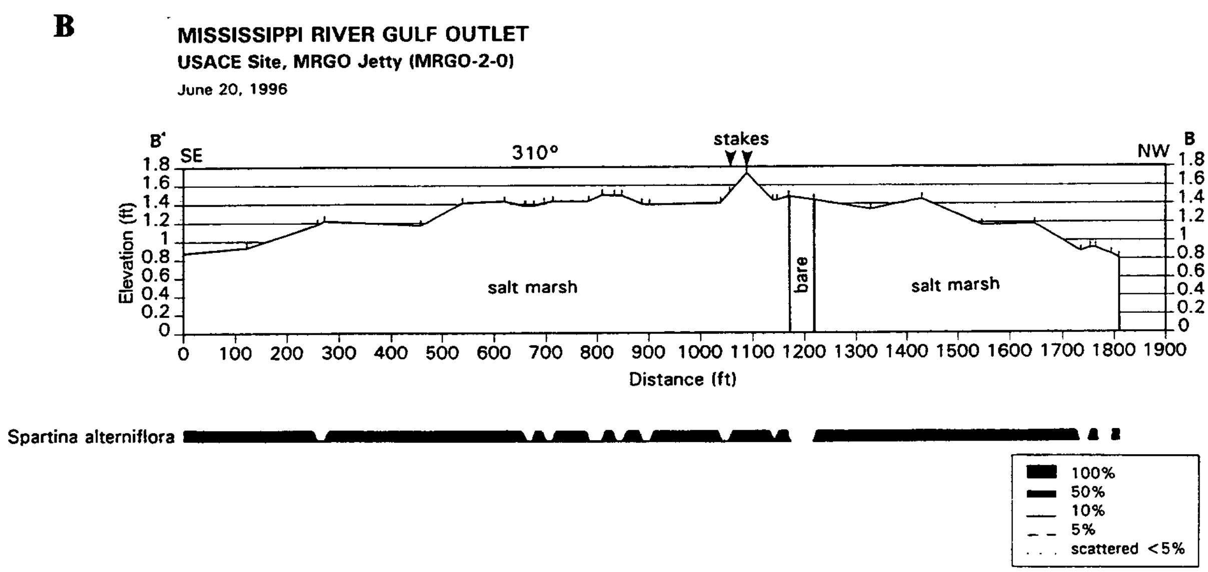


Figure 6. A comparison between 1995 and 1996 data for the dip profile at stake 2.0 (B-B') at MRGO Jetties peninsula showing colonization of vegetation over a one-year period. A) 1995 elevation and vegetation data. B) 1996 elevation and vegetation data.

MRGO Jetties Pipeline

This transect was recorded from the nearshore water of Breton Sound, across the profile, and well into the marsh on the other side. The profile was 1050 feet in length. Maximum relief along the profile was found on the retaining levee on the north side of the pipeline of 5.7 feet, with an average relief of 1.64 feet (Figure 7). The pipeline area was characteristically defined as a low relief tidal flat, well colonized by saltmarsh. The surficial sedimentology of the area is composed of tidalite type sediments (silty clays, with very fine quartz sand).

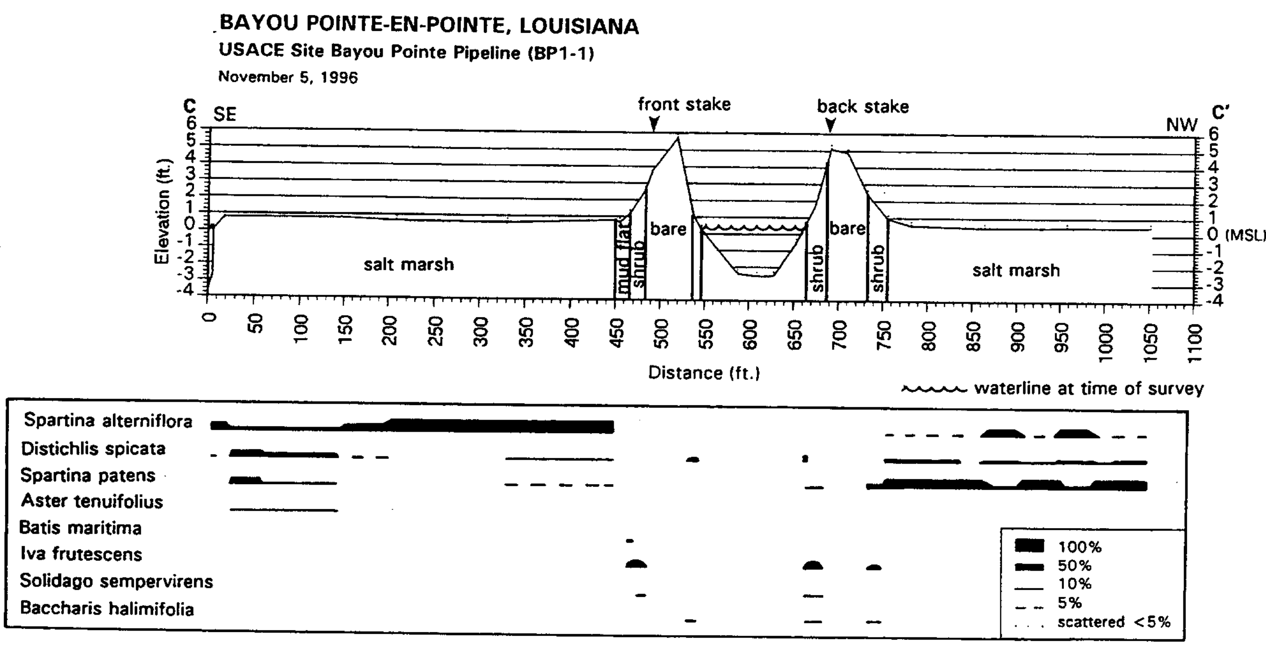


Figure 7. 1996 Elevation profile of MRGO-Jetties Pipeline near Bayou Pointe en Pointe with vegetation data illustrated.

Vegetative Character

General Description

The overall marsh type for this area would be classified as salt marsh. The only other vegetative habitat found at this site was a narrow shrub/scrub zone occupying a ridge near to and paralleling the jetty. The substrate was very soft, fine-grained silt and mud. This was a very active, high bird-use area.

The material deposited in the unconfined disposal area at Mile 20.5 was very successful in inducing saltmarsh colonization. However, much of the material deposited within the pipelines near Mile 27-28 appears to have been removed by tidal action and was shallow open water at the time of the transect.

Vegetative community types

The salt marsh in the study area was represented exclusively by *Spartina alterniflora*, growing thickly throughout the mudflat area.

Shrub communities usually indicate older, more stable, elevated areas. The narrow shrub zone near the jetty was primarily 5-6 foot *Iva frutescens* with some *Baccharis halimifolia* and an understory of *Borrichia frutescens* and *Distichlis spicata*.

GIS ANALYSIS RESULTS

Shoreline Changes: 1985-1996

Figure 8 graphs the spatial history of the MRGO - Jetties BUMP study area between December 1985 and February 1995 shown in Table 1 and illustrated in figure 9. In December 1985, the jetties BUMP study area was measured at 2594.0 acres. The jetties area of the MRGO in November 1996 was measured at 2466.9 acres. This is an area decrease of - 127.1 acres or a decrease in area of 5 percent. Between 1985 and 1996, the rate of area lost was about -11.6 acres per year. Without the contribution of the new habitats due to the beneficial use of dredged material, the total coastal land loss in the study area would have exceeded 301.0 acres at a rate of -27.4 acres per year.

Between December 1985 and February 1995, the total area of the jetties area decreased by 120.2 acres at a rate of -127.1 acres per year for this - 11.6 year period. The primary areas of progradation took place along the south side of the jetty. Land loss was associated with the north side of the jetty, navigation channel margin, and the expansion of interior ponds.

Between February 1995 and November 1995, the study area decreased by 145.3 acres. Land gain occurred primarily in the beneficial use disposal areas. Land loss occurred throughout the study area.

Between November 1995 and November 1996, the area for this time period increased by +138.4 acres. Land gain occurred primarily in the beneficial use and other man-made disposal areas. Land loss occurred in isolated ponds in the study area.

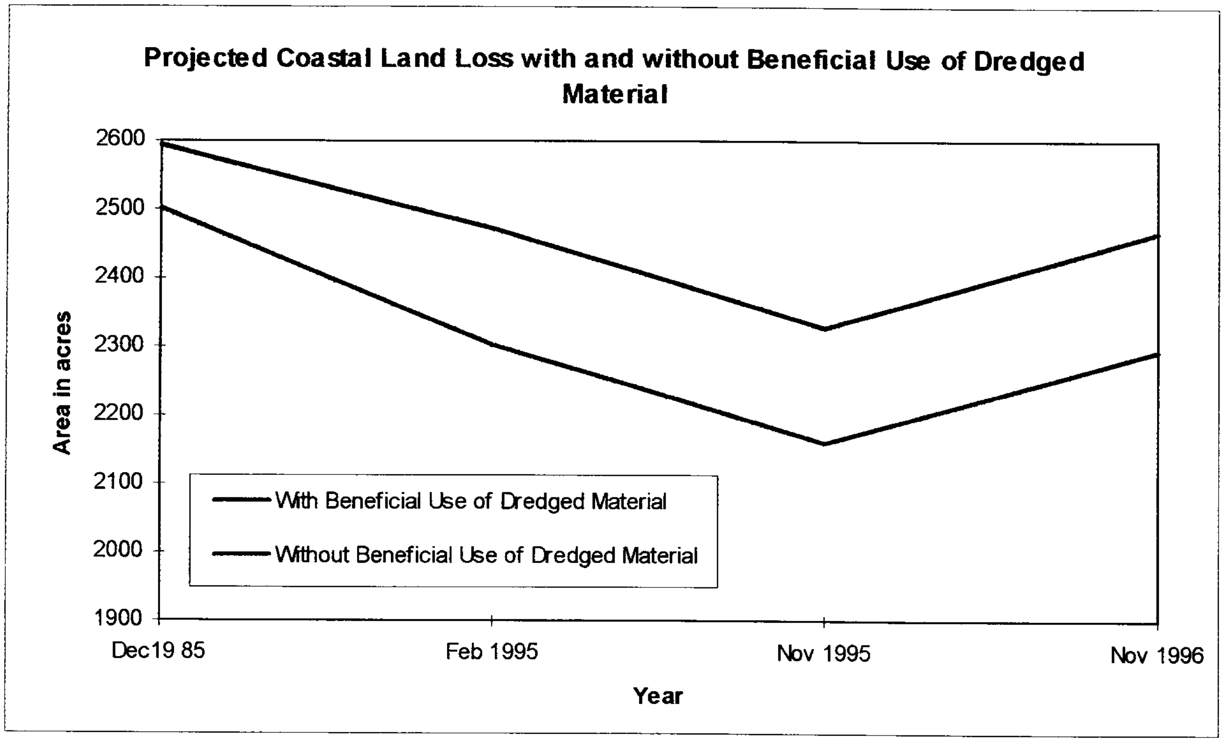
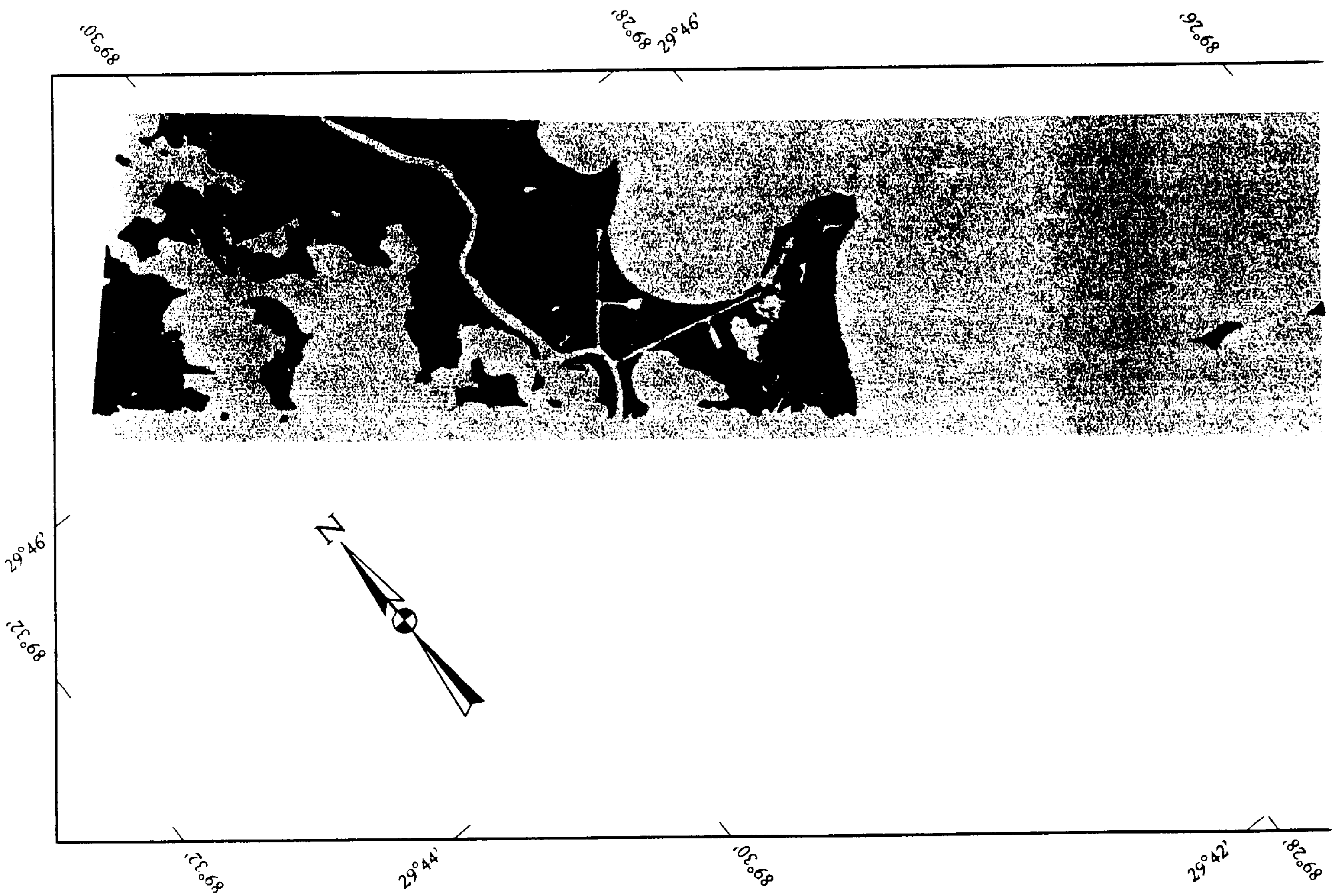


Figure 8. Graph of the area of the Mississippi River Gulf Outlet - Jetties BUMP study area over time, with and without the placement of dredged material.

TABLE 1
MRGO- Jetties Area: 1985-1996

Area in acres	Dec 1985	Feb 1995	Nov 1995	Nov 1996
Natural Areas	2211.5	2035.7	2019.4	2015.8
Other Man-made Areas	291.3	268.6	142.1	277.2
BUMP-made Areas	91.2	169.5	167.0	173.9
	2594.0	2473.8	2328.5	2466.9


89°30'
89°28'
29°46'
89°26'
29°46'
89°32'
N
89°32'
29°44'
89°30'
29°42'
89°28'

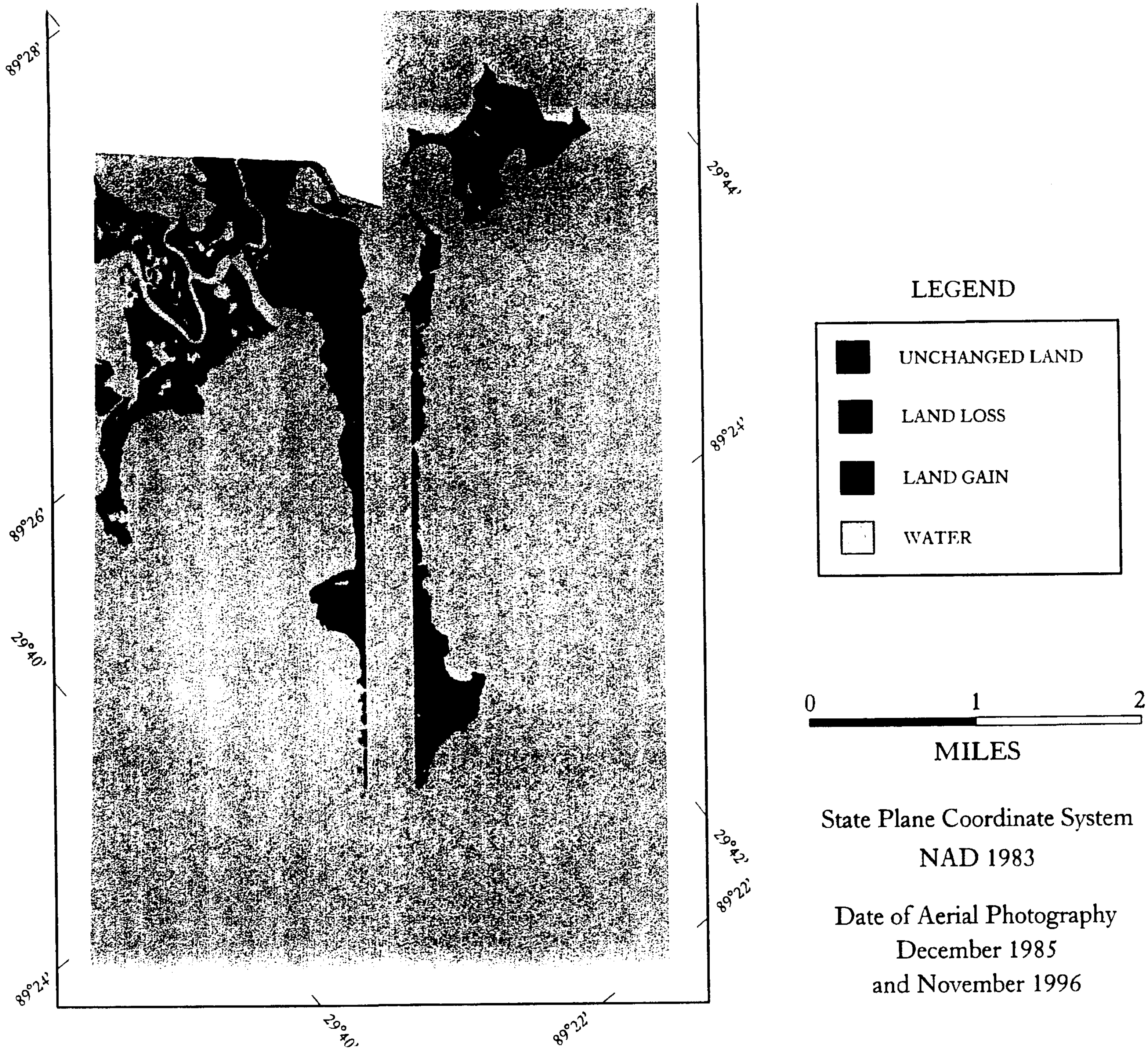


Figure 9. Shoreline changes of the Mississippi River Gulf Outlet - Jetties BUMP study area between December 1985 and November 1996.

Habitat Inventory

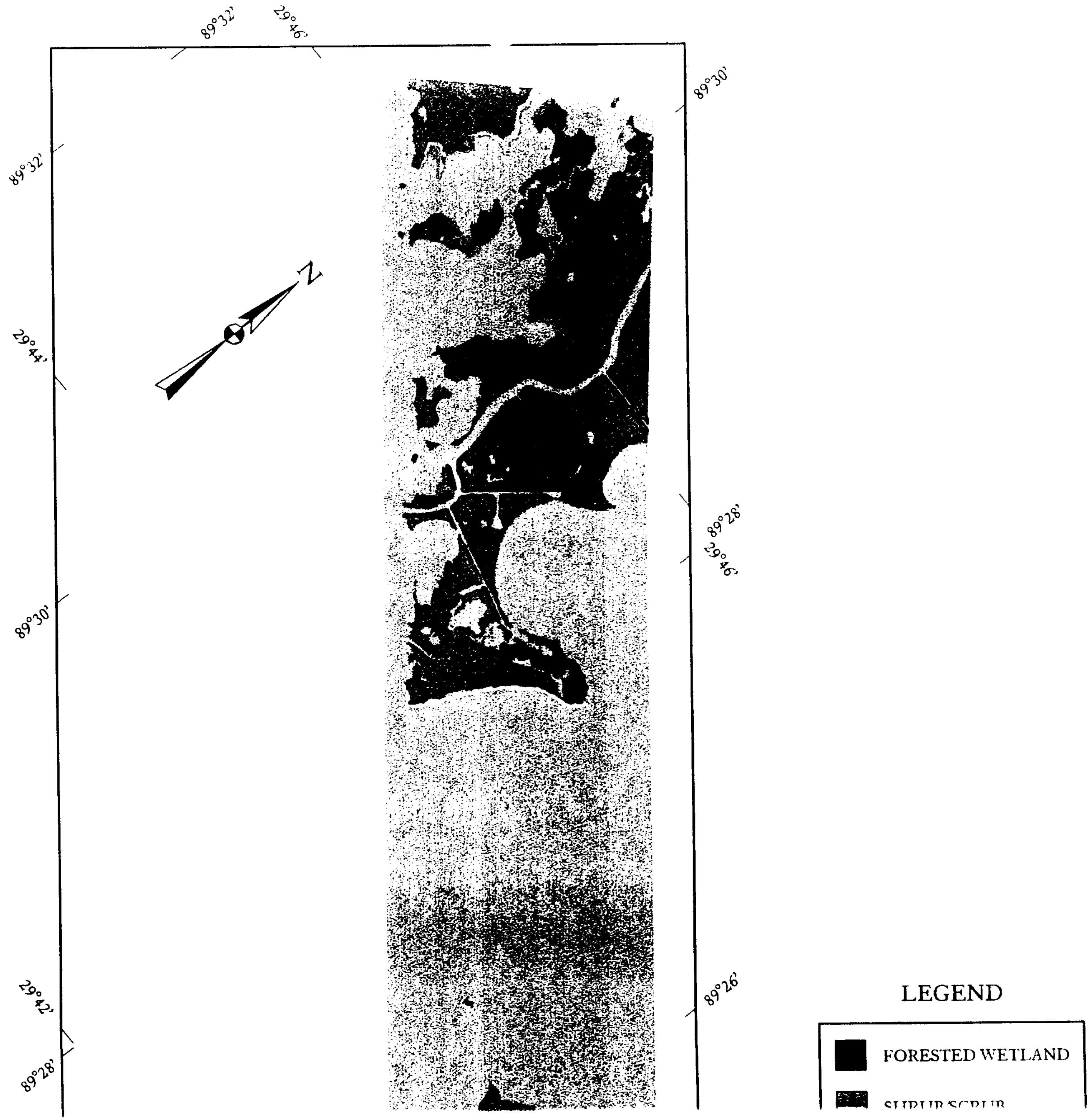
The aerial photographic interpretation combined with field surveys identified six major habitat types in the MRGO - Jetties BUMP study area. These habitats are further classified as natural and man-made. The natural class identifies natural deltaic processes as responsible for habitat creation. The BUMP man-made (BUMP-made) class identifies the habitats created by the placement of dredged material. The Non-BUMP man-made class (other-made) separates areas created that were not part of the BUMP effort, such as areas created in association with the oil industry access and pipeline canals. On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

Table 2 lists the areas of the five habitat types found in the MRGO - Jetties BUMP study area in December 1985. The location and arrangement of these habitats is presented in figure 10. The total area of the MRGO jetties site was 2594 acres. Of this total, 2211.5 acres were natural and 382.5 acres were other-made including 91.2 acres of BUMP-made and 291.3 acres of other-made or 85 percent were natural, 4 percent were BUMP-made and 11 percent were other-made. In order of decreasing size and importance, the largest habitat found was natural marsh (2088.0 acres) followed by other-made marsh (157.5 acres), natural upland (104.5 acres), other-made shrub/scrub (67.6 acres), other-made upland (42.3 acres), BUMP-made bare land (39.3 acres), BUMP-made marsh (35.8 acres), natural beach (18.4 acres), other-made beach (15.0 acres), BUMP-made beach (9.3 acres), other-made bare land (8.9 acres), BUMP-made upland (6.8 acres), and natural bare land (0.6 acres). The December 1985 MRGO - Jetties inventory did not delineate any natural or BUMP-made shrub/scrub habitat areas.

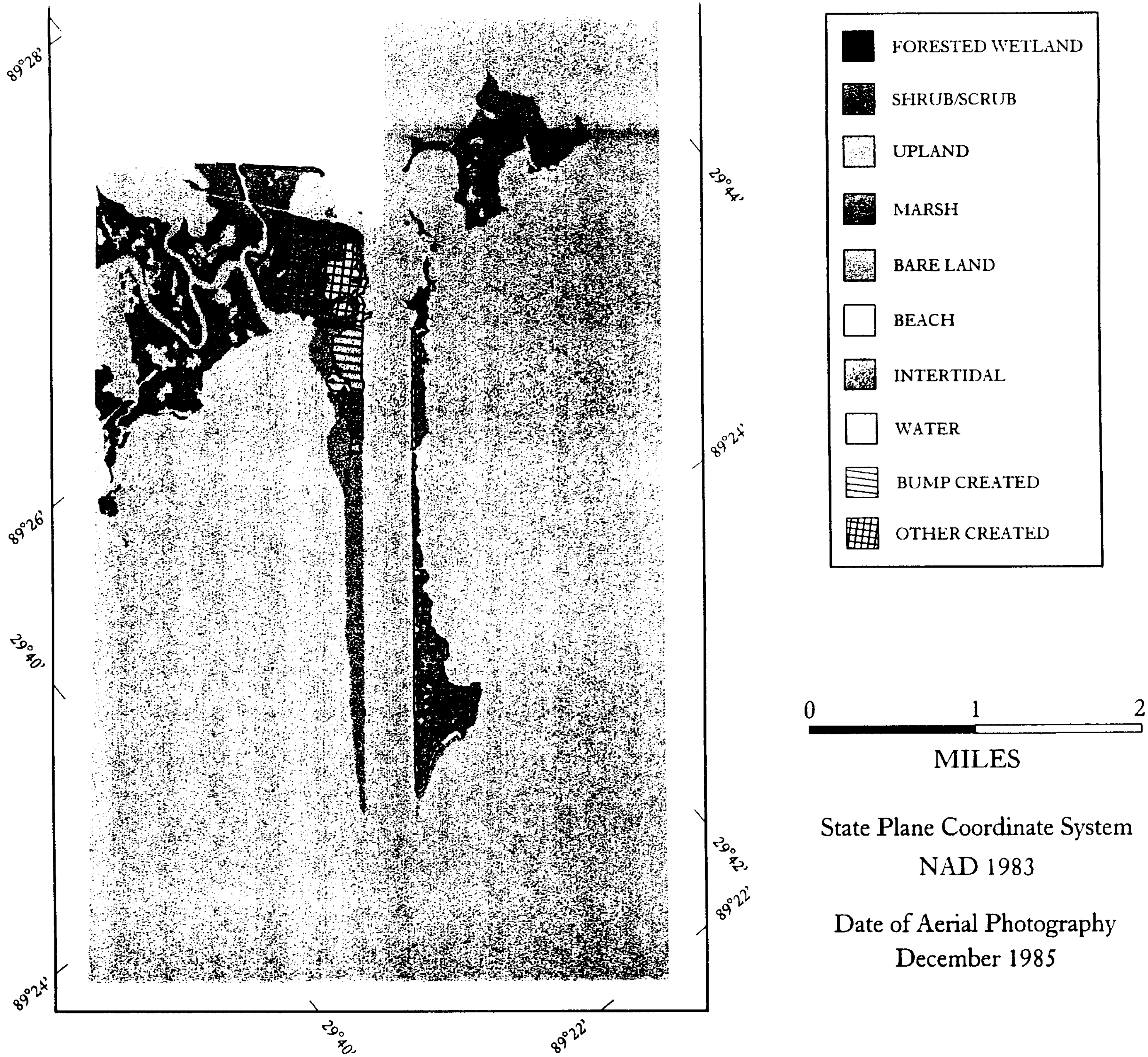
In terms of habitat totals, marsh (2281.3 acres) dominated the MRGO - Jetties landscape.

TABLE 2
December 1985 Habitat Inventory of the MRGO-Jetties BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	2281.3	2088.0	157.5	35.8
Upland	153.6	104.5	42.3	6.8
Shrub/Scrub	67.6	0.0	67.6	0.0
Bare Land	48.8	0.6	8.9	39.3
Beach	42.7	18.4	15.0	9.3
Habitat Total	2594.0	2211.5	291.3	91.2


89°32'
29°46'
89°30'
89°32'
29°44'
N
89°28'
29°46'
89°30'
29°42'
89°28'
89°26'
LEGEND
FORESTED WETLAND

(1)



②

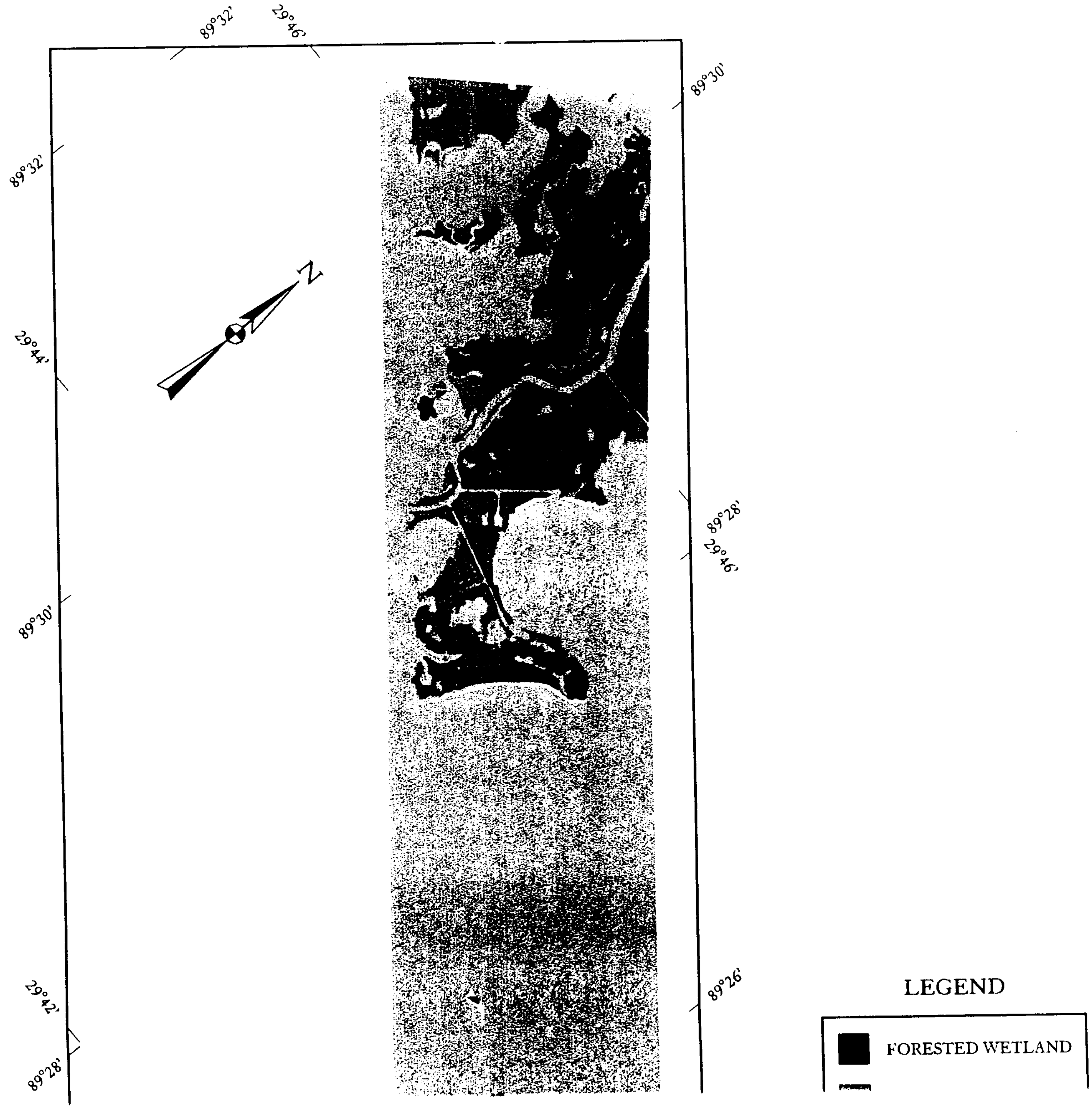
Figure 10. Habitat inventory map of the Mississippi River Gulf Outlet - Jetties BUMP study area in December 1985.

Table 3 lists the areas of the five habitats found in the Mississippi River Gulf Outlet - Jetties BUMP study area in February 1995. The location and arrangement of these habitats is presented in figure 11. In February 1995, the total area of the MRGO - Jetties BUMP study area was calculated at 2473.8 acres. Of this total, 2035.7 acres were natural and 438.1 acres were man-made including 169.5 acres BUMP-made and 268.6 acres other-made, or 82 percent was natural, 7 percent was BUMP-made and 11 percent was other-made. In order of decreasing size and importance, the largest habitat found is natural marsh (1826.3 acres) followed by natural upland (173.9 acres), other-made marsh (146.3 acres), BUMP-made marsh (103.2 acres), other-made shrub/scrub (94.3 acres), BUMP-made bare land (39.6 acres), natural beach (26.5 acres), BUMP-made shrub/scrub (14.3 acres), other-made beach (11.5 acres), other-made bare land (10.4 acres), BUMP-made beach (7.2 acres), other-made upland (6.1 acres), natural bare land (5.5 acres), and BUMP-made upland (5.2 acres).

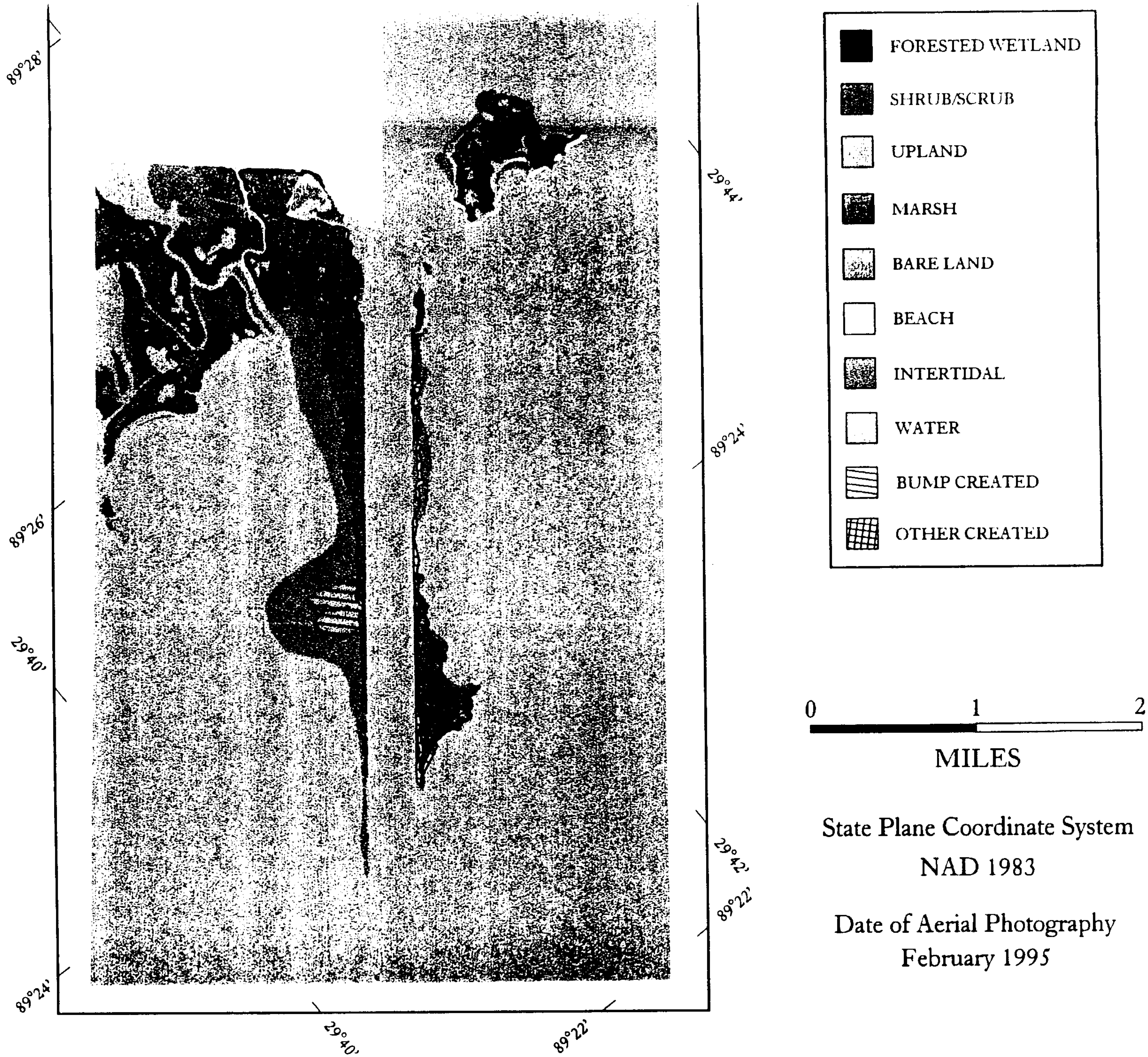
In terms of total area, marsh (2075.8 acres) dominated the landscape of the MRGO - Jetties BUMP study area.

TABLE 3
February 1995 Habitat Inventory of the MRGO-Jetties BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	2075.8	1826.3	146.3	103.2
Upland	185.2	173.9	6.1	5.2
Shrub/Scrub	112.1	3.5	94.3	14.3
Bare Land	55.5	5.5	10.4	39.6
Beach	45.2	26.5	11.5	7.2
Habitat Total	2473.8	2035.7	268.6	169.5


89°32'
29°46'
89°30'
89°32'
N
29°44'
89°28'
29°46'
89°30'
29°42'
89°28'
89°26'
LEGEND
FORESTED WETLAND

①



2

Figure 11. Habitat inventory map of the Mississippi River Gulf Outlet - Jetties BUMP study area in February 1995.

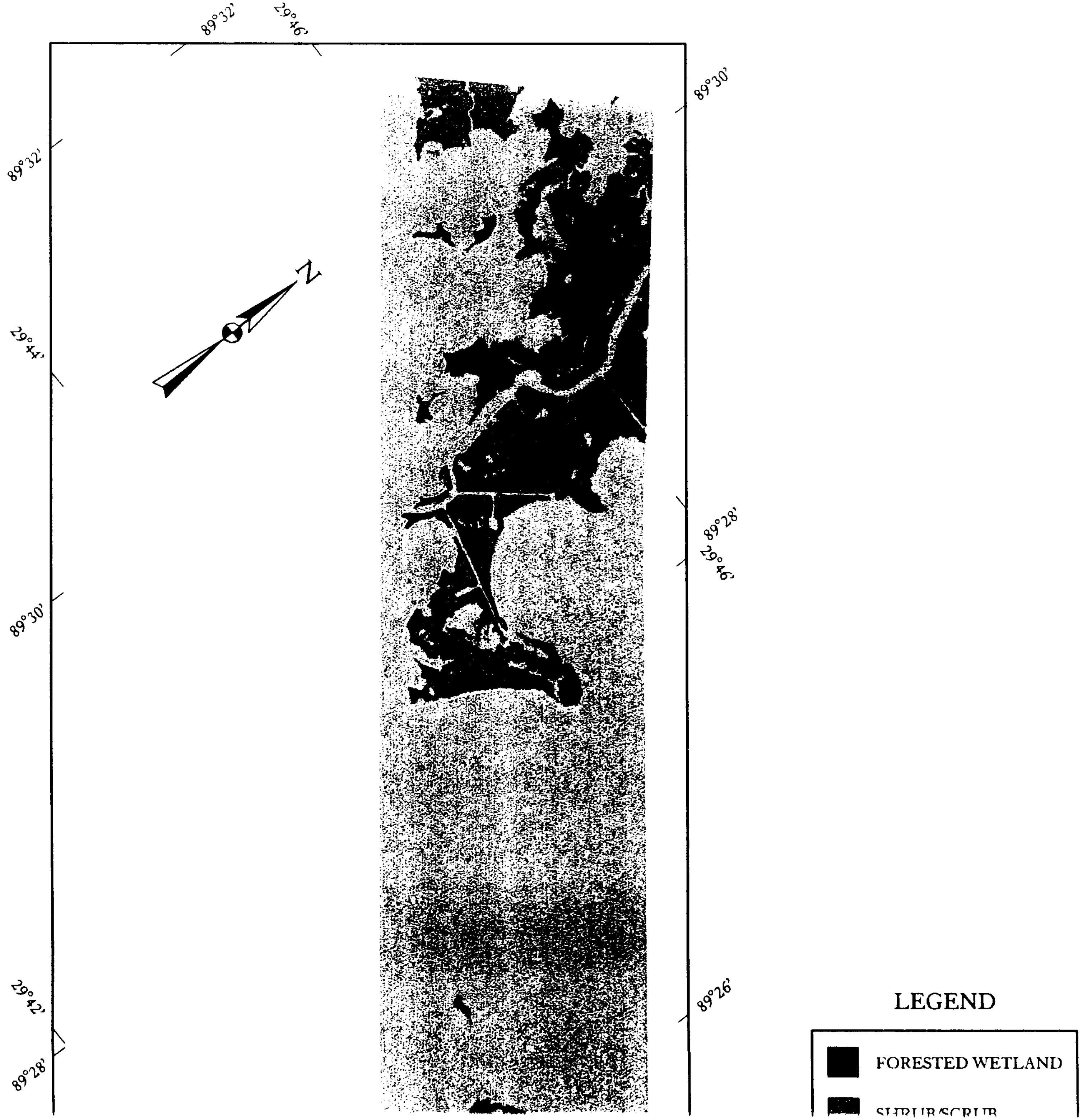
Table 4 lists the areas of the five habitats found in the Mississippi River Gulf Outlet - Jetties BUMP study area in November 1995. The location and arrangement of these habitats is presented in figure 12. In November 1995, the total area of the MRGO - Jetties BUMP study area was calculated at 2328.5 acres. Of this total, 2019.4 acres were natural and 309.1 acres were man-made including 167.0 acres BUMP-made and 142.1 acres other-made, or 88 percent was natural, 6 percent was BUMP-made and 6 percent was other-made.

In order of decreasing size and importance, the largest habitat found is natural marsh (1787.0 acres) followed by natural upland (223.5 acres), BUMP-made (130.2 acres), other-made marsh (118.7 acres), BUMP-made beach (22.0 acres), other-made beach (17.7 acres), natural bare land (8.9 acres), BUMP-made shrub/scrub (7.9 acres), BUMP-made bare land (6.9 acres) and other-made bare land (5.7 acres). The November 1995 MRGO inventory did not delineate any other-made or BUMP-made upland habitat, natural or other-made shrub/scrub, or natural beach habitat areas.

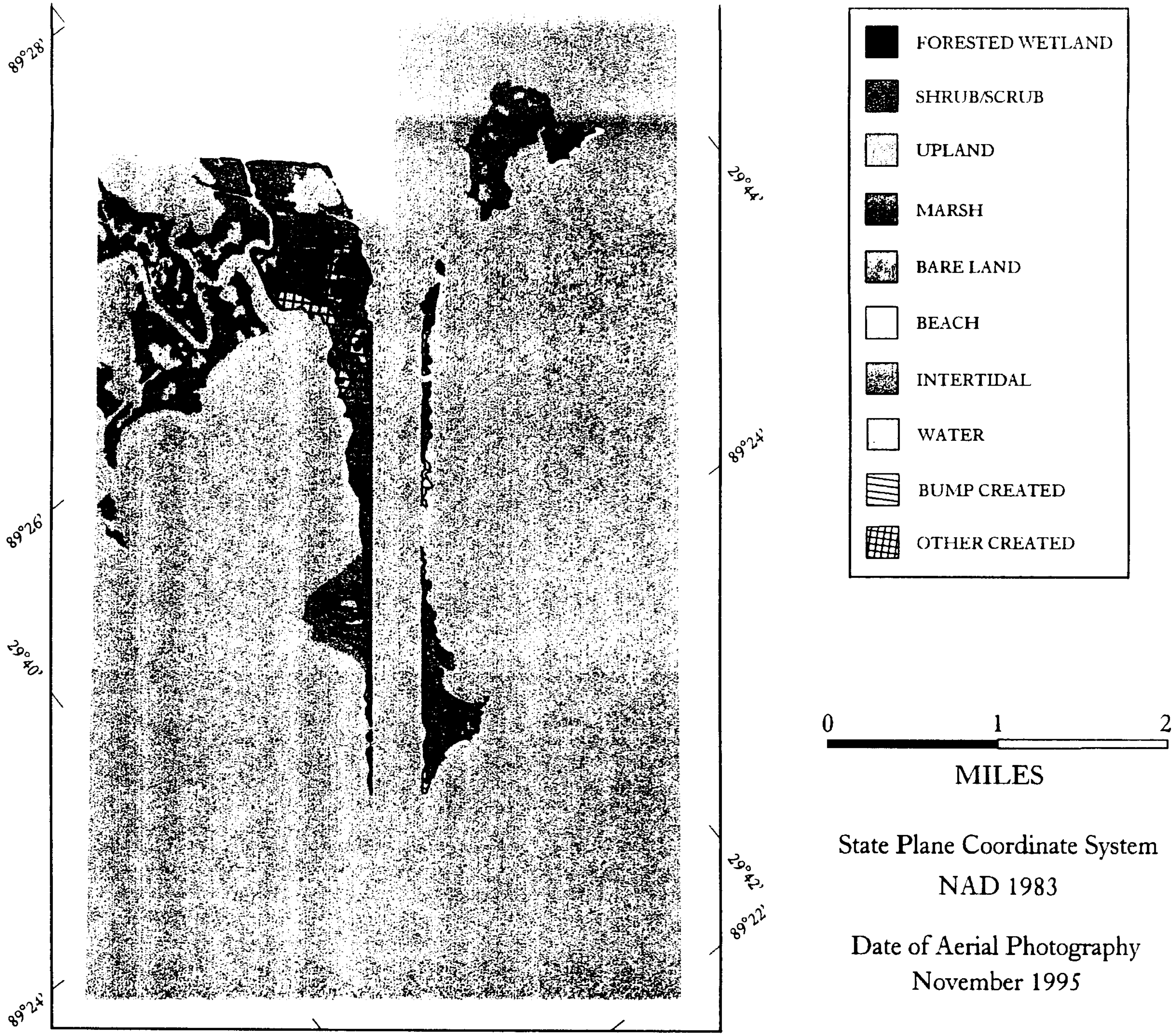
In terms of total area, marsh (2035.9 acres) dominated the landscape of the MRGO - Jetties BUMP study area.

TABLE 4
November 1995 Habitat Inventory of the MRGO-Jetties BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	2035.9	1787.0	118.7	130.2
Upland	223.5	223.5	0	0
Shrub/Scrub	7.9	0	0	7.9
Bare Land	21.5	8.9	5.7	6.9
Beach	39.7	0	17.7	22.0
Habitat Total	2328.5	2019.4	142.1	167.0


89°32'
29°46'
89°30'
89°32'
29°44'
N
89°28'
29°46'
89°30'
29°42'
89°26'
89°28'
LEGEND
FORESTED WETLAND
SHRUB/SCRUB

(1)



2

Figure 12. Habitat inventory map of the Mississippi River Gulf Outlet - Jetties BUMP study area in November 1995.

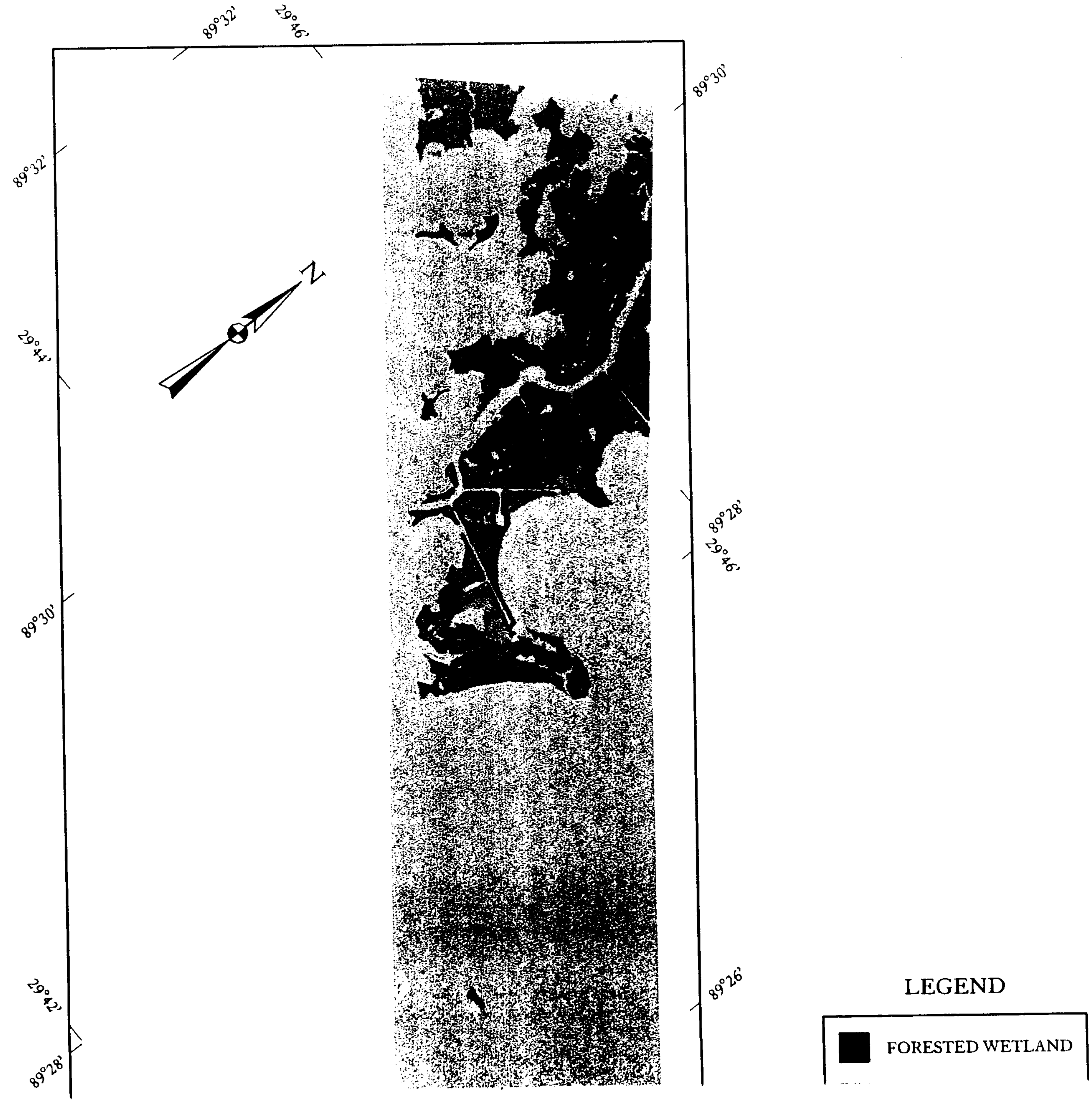
Table 5 lists the areas of the five habitats found in the Mississippi River Gulf Outlet - Jetties BUMP study area in November 1996. The location and arrangement of these habitats is presented in figure 13. In 1996, the total area of the MRGO - Jetties BUMP study area was calculated at 2466.9 acres. Of this total, 2015.8 acres were natural and 451.1 acres were man-made including 173.9 acres BUMP-made and 277.2 acres other-made, or 82 percent was natural, 7 percent was BUMP-made and 11 percent was other-made.

In order of decreasing size and importance, the largest habitat found is natural marsh (1774.0 acres) followed by natural upland (227.3 acres), BUMP-made marsh (136.4 acres), other-made marsh (118.7 acres), other-made shrub/scrub (93.4 acres), other-made beach (38.0 acres), BUMP-made beach (20.1 acres), other-made upland (20.0 acres), natural beach (10.2 acres), BUMP-made bare land (9.5 acres), BUMP-made shrub/scrub (7.9 acres), and natural bare land (4.3 acres). The November 1996 inventory did not delineate any BUMP-made upland or natural shrub/scrub habitat areas.

In terms of total area, marsh (2029.1 acres) dominated the landscape of the MRGO - Jetties BUMP study area.

TABLE 5
November 1996 Habitat Inventory of the MRGO-Jetties BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	2029.1	1774.0	118.7	136.4
Upland	247.3	227.3	20.0	0.0
Shrub/Scrub	101.3	0.0	93.4	7.9
Bare Land	20.9	4.3	7.1	9.5
Beach	68.3	10.2	38.0	20.1
Habitat Total	2466.9	2015.8	277.2	173.9


89°32'
29°46'
89°30'
89°32'
N
29°44'
89°28'
29°46'
89°30'
89°26'
29°42'
89°28'
LEGEND
FORESTED WETLAND

1

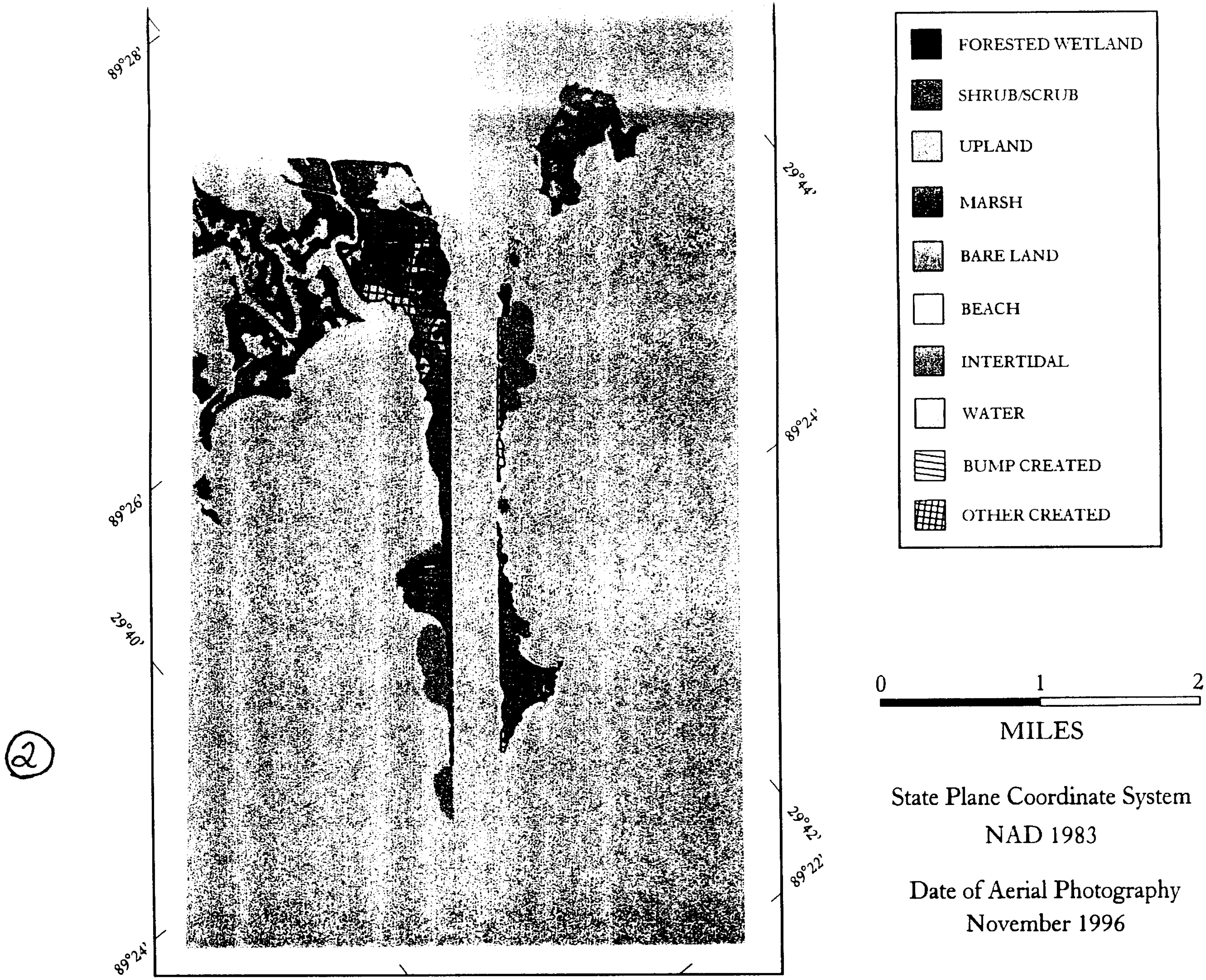


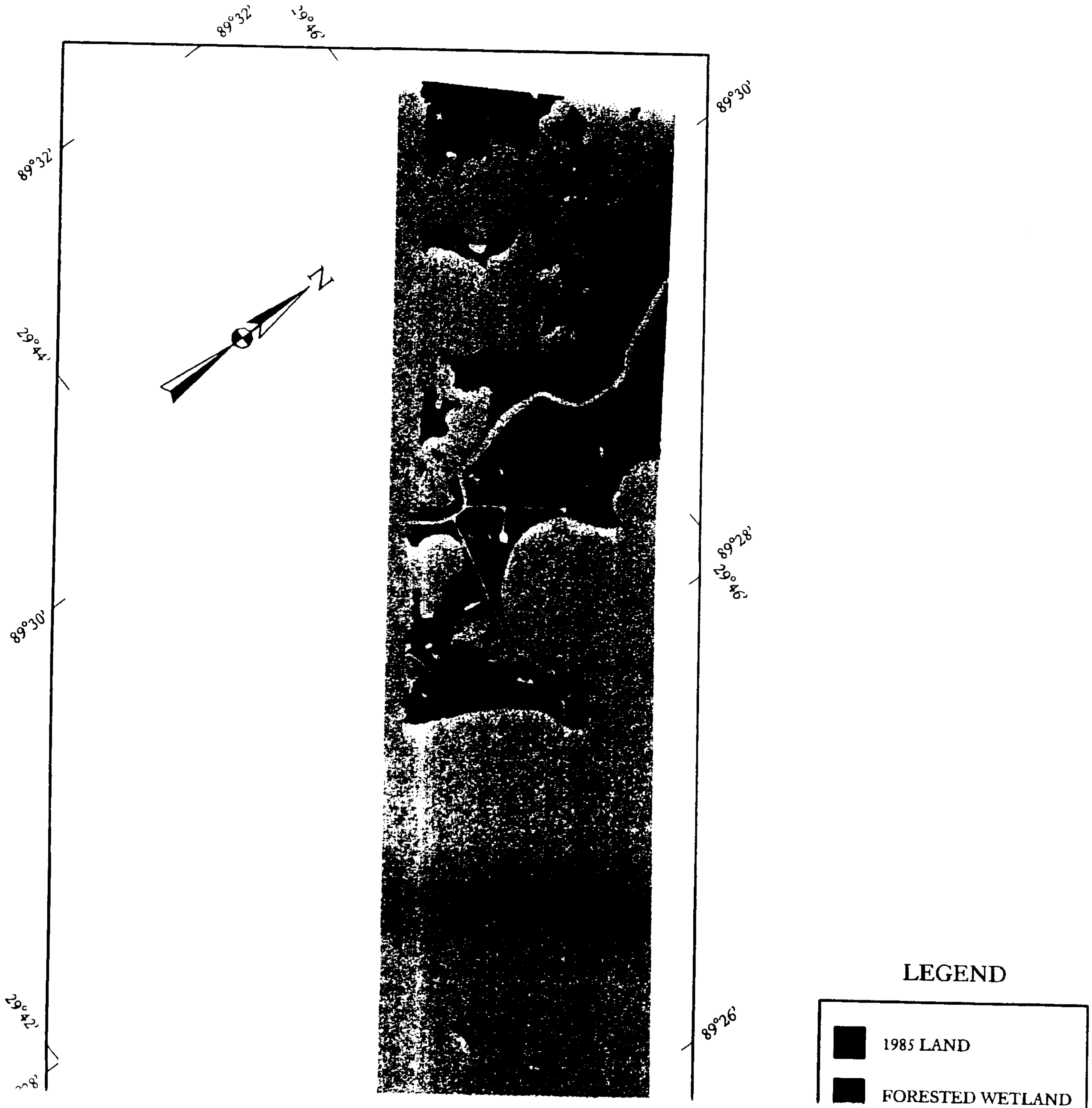
Figure 13. Habitat inventory map of the Mississippi River Gulf Outlet - Jetties BUMP study area in November 1996.

Habitat Change

Figure 14 shows the creation of new habitat, both natural and man-made, along the MRGO - Jetties BUMP study area by comparing December 1985 and November 1996. Land loss dominates the natural processes of this area. The total area decreased by -127.1 acres which represents a -5 percent decrease in area between 1985 and 1996. There was an overall decrease of -195.7 acres of the natural habitats and a decrease of -14.1 acres in other-made habitats, offset by an overall +82.7 acres of increase in man-made habitats due to the placement of dredged materials. Table 6 lists the major habitat changes during the period between December 1985 and November 1996.

The major habitat-change was the cumulative decrease by natural processes of natural marsh (-314.0 acres). In terms of the beneficial use process, the greatest areas of new habitat creation include BUMP-made marsh (+100.6 acres), BUMP-made beach (+10.7 acres), and BUMP-made shrub/scrub (+7.9 acres).

Figure 15 shows a time series of habitat changes along the MRGO- Jetties BUMP study area. 15A graphs the natural habitat changes over time. Natural marsh erosion dominates the natural habitat class. 15B graphs the man-made habitat changes. Marsh creation by beneficial use of dredged material dominates the man-made class.


89°32'
29°46'
89°30'
89°32'
29°44'
N
89°28'
29°46'
89°30'
29°42'
89°26'
LEGEND
1985 LAND
FORESTED WETLAND

①

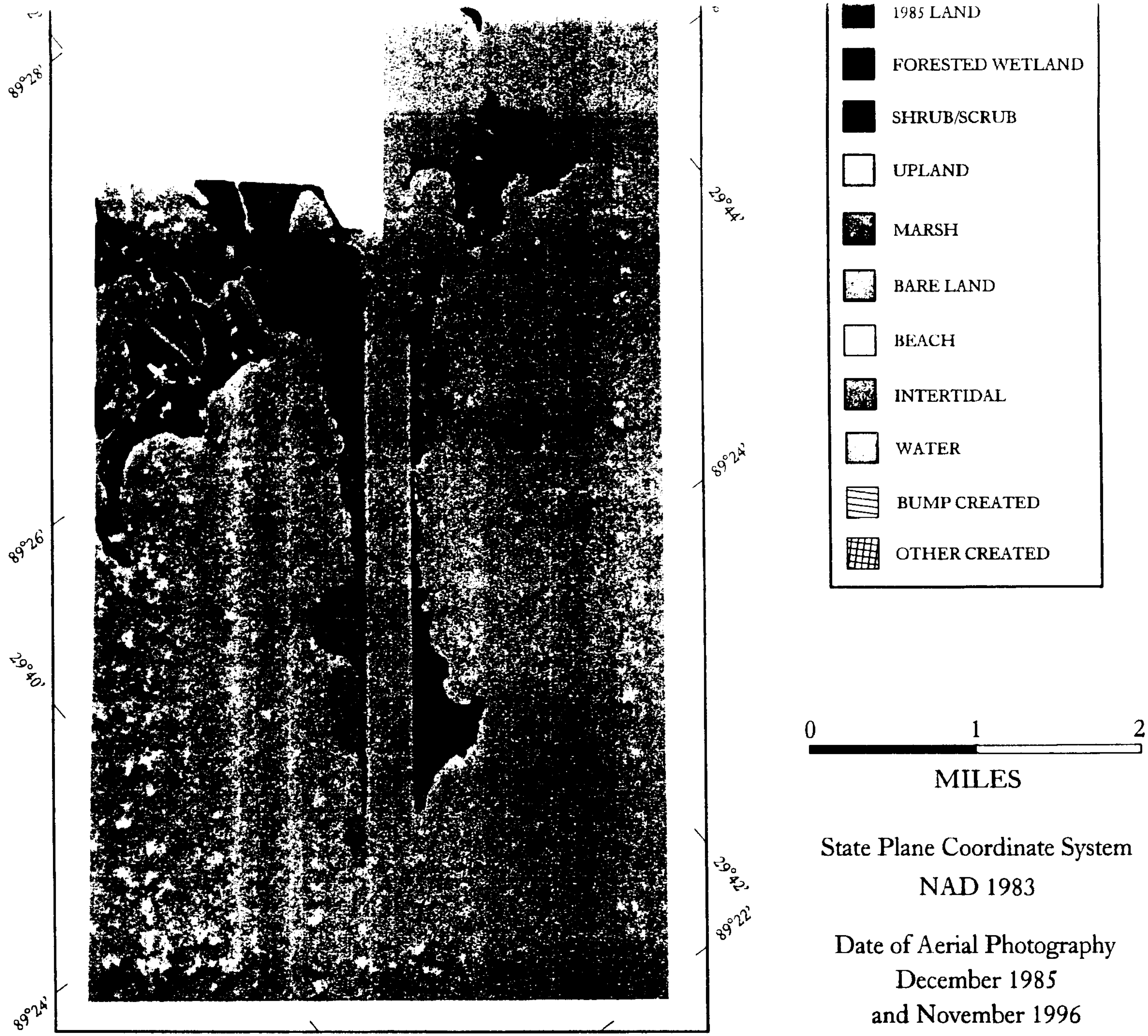


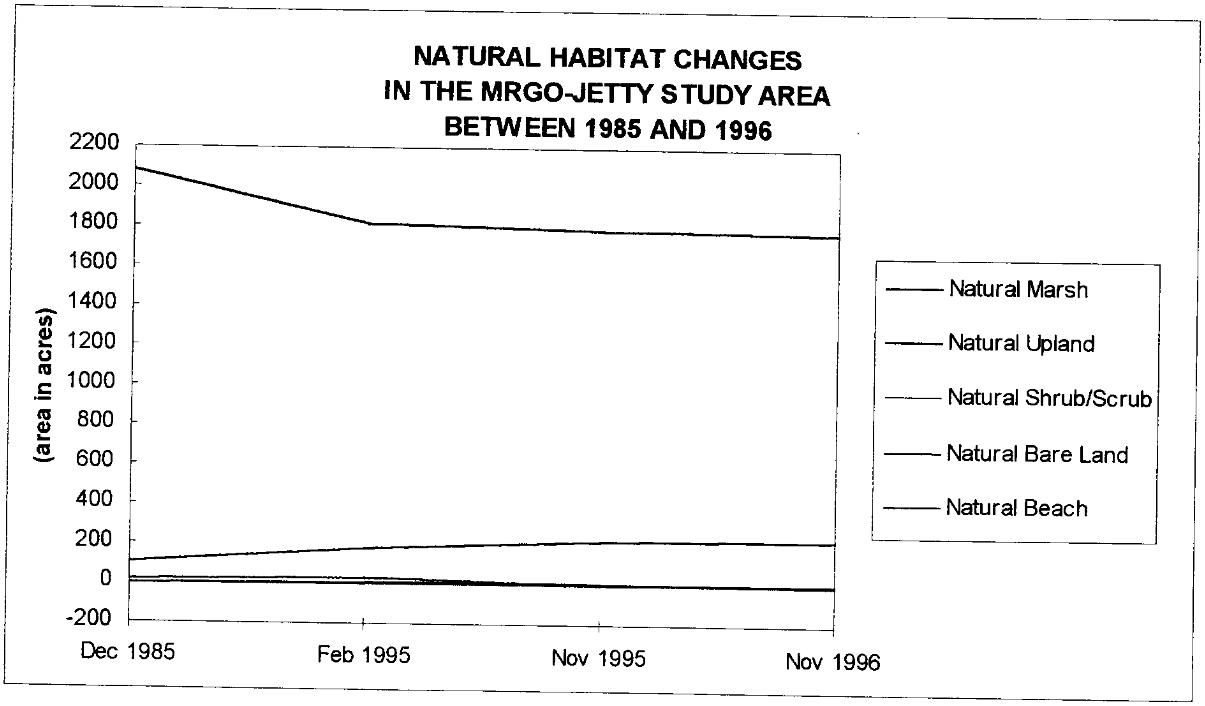
Figure 14. Map of the Mississippi River Gulf Outlet - Jetties BUMP study area showing the new habitats created by beneficial use of dredged materials or formed by natural processes between December 1985 and November 1996.

②

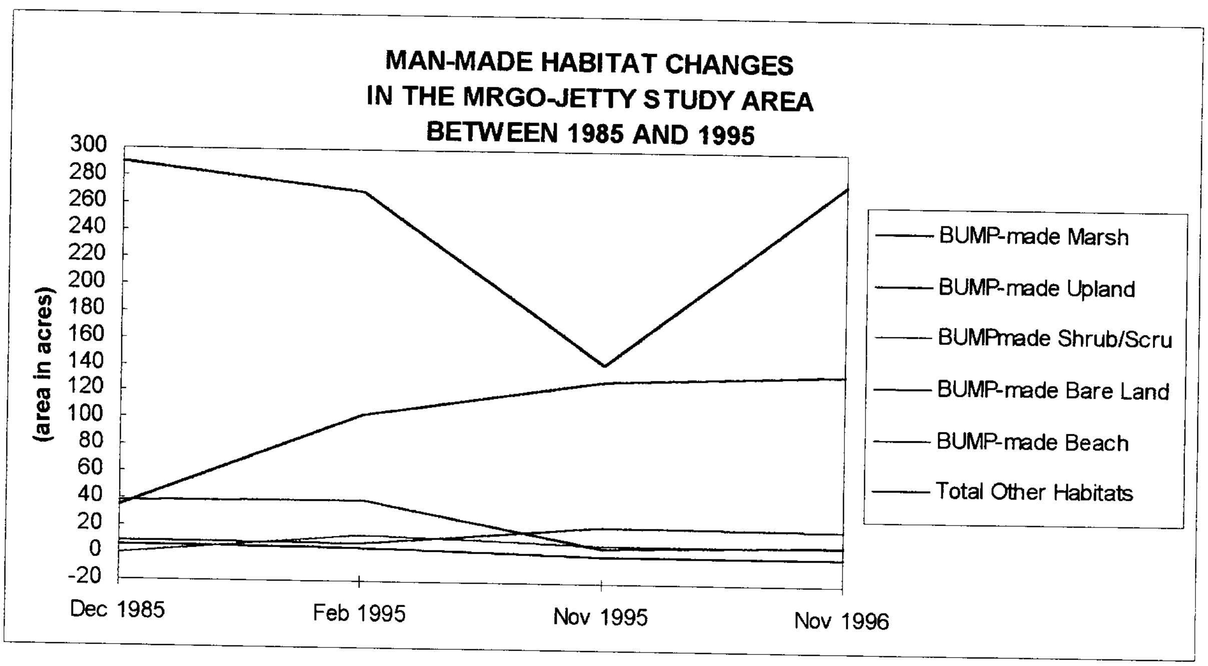
TABLE 6
Change in Total Acres of each Habitat
in the MRGO-Jetties BUMP Study Area between 1985 and 1996

HABITAT	Dec 1985-Feb 1995[1]	Feb 1995-Nov 1995[1]	Nov 1995 Nov 1996[1]	Dec 1985-Nov 1996[1]
Natural Marsh	-261.7	-39.3	-13.0	-314.0
Natural Upland	+69.4	+49.6	+3.8	+122.8
Natural Shrub/Scrub	+3.5	-3.5	0.0	0.0
Natural Bare Land	+4.9	+3.4	-4.6	+3.7
Natural Beach	+8.1	-26.5	+10.2	-8.2
Total Natural Habitats	-175.8	-16.3	-3.6	-195.7
Other Man-made Marsh	-11.2	-27.6	0.0	-38.8
Other Man-made Upland	-36.2	-6.1	+20.0	-22.3
Other Man-made Shrub/Scrub	+26.7	-94.3	+93.4	+25.8
Other Man-made Bare Land	+1.5	-4.7	+1.4	-1.8
Other Man-made Beach	-3.5	+6.2	+20.3	+20.3
Total Other Man-made Habitats	-22.7	-126..5	+135.1	-14.1
BUMP-made Marsh	+67.6	+27.0	+6.2	+100.8
BUMP-made Upland	-1.7	-5.2	0.0	-6.9
BUMP-made Shrub/scrub	+14.3	-6.4	0.0	+7.9
BUMP-made Bare Land	+0.3	-32.7	+2.6	-29.8
BUMP-made Beach	-2.2	-14.8	-1.9	+10.7
Total BUMP-made Habitats	+78.3	-2.5	+6.9	+82.7
HABITAT TOTAL	-120.2	-145.3	+138.4	-127.1

[1] in acres



A



B

Figure 15. Time series showing the changes in total area of each habitat in the MRGO - Jetties BUMP study area between December 1985 and November 1996. A) natural habitat changes. B) man-made habitat changes.

CONCLUSIONS

1. The total area of the MRGO - Jetties BUMP study area in December 1985 was 2594.0 acres. Natural processes accounted for 2211.5 acres or 85 percent of the total area. Man-made processes related to beneficial use of dredged material accounted for +91.2 acres or 4 percent of the total area. Other man-made area accounted for 291.3 acres or 11 percent of the study area.

2. The total area of the MRGO - Jetties BUMP study area in November 1996 was 2466.9 acres. Natural processes accounted for 2015.8 acres or 82 percent of the total area. Man-made processes related to the beneficial use of dredged material accounted for 173.9 acres or 7 percent of the total area. Other man-made areas accounted for 277.2 acres or 11 percent of the study area.

3. The MRGO - Jetties BUMP study area decreased by -127.1 acres between December 1985 and November 1996. Natural processes were responsible for -195.7 acres of decrease and the beneficial use of dredged material was responsible for +82.7 acres of increase.

4. Natural processes are responsible for eroding the marsh. Beneficial use of dredged material appears to be effective in creating a variety of habitats including beach, shrub/scrub, bare land, and marsh.

5. The field surveys indicate the current stacking heights are optimal for creating marsh and to a lesser extent shrub/scrub. The optimal elevation for marsh creation appears to be less than +2 feet MSL (+2.78 feet MLG).

6. At the MRGO - Jetties BUMP study area, the beneficial use of dredged material created +82.7 acres of new habitat between December 1985 and November 1996. This total includes: +100.8 acres of marsh, +7.9 acres of shrub/scrub, and +10.7 acres of beach. In contrast, BUMP related upland decreased by -6.8 acres and beach by -29.8 acres.

7. Within the MRGO - Jetties BUMP study area, the beneficial use of dredged material reduced the amount of coastal land loss by 39 percent.

APPENDIX 3A

LIST OF VEGETATIVE SPECIES
IN THE MISSISSIPPI RIVER GULF OUTLET - JETTIES

LIST OF VEGETATIVE SPECIES
IN THE MISSISSIPPI RIVER GULF OUTLET - JETTIES

An alphabetical list of observed and collected plant species follows. This list is not complete, but is meant to establish vegetative character and indicate dominant species observed. The list includes the species name, alternate scientific names, common names, and general habitat description for each plant. The habitat information was taken from the Manual of the Vascular Flora of the Carolinas or The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts.

Aster tenuifolius L. . . . . perennial saltmarsh aster
perennial; fresh to brackish marsh

Baccharis halimifolia L. . . . . Groundselbush
shrub; elevated sites in fresh to saline marshes

Batis maritima L. . . . . Saltwort
succulent subshrub; salt marshes, salt flats, brackish marshes, muddy seashores, drift zones

Borrichia frutescens (L.) . . . . sea ox-eye
rhizomatous shrub; brackish marsh or upper zones of salt marsh

Distichlis spicata (L.) Greene . . . . salt grass
rhizomatous perennial; brackish marshes and flats

Iva frutescens L. . . . . marsh elder
shrub; brackish marshes, upper zones of salt marsh

Solidago sempervirens L. . . . . seaside goldenrod
perennial; brackish marsh or saline sand

Spartina alterniflora Loisel. . . . . oyster grass
rhizomatous perennial; salt and brackish marshes

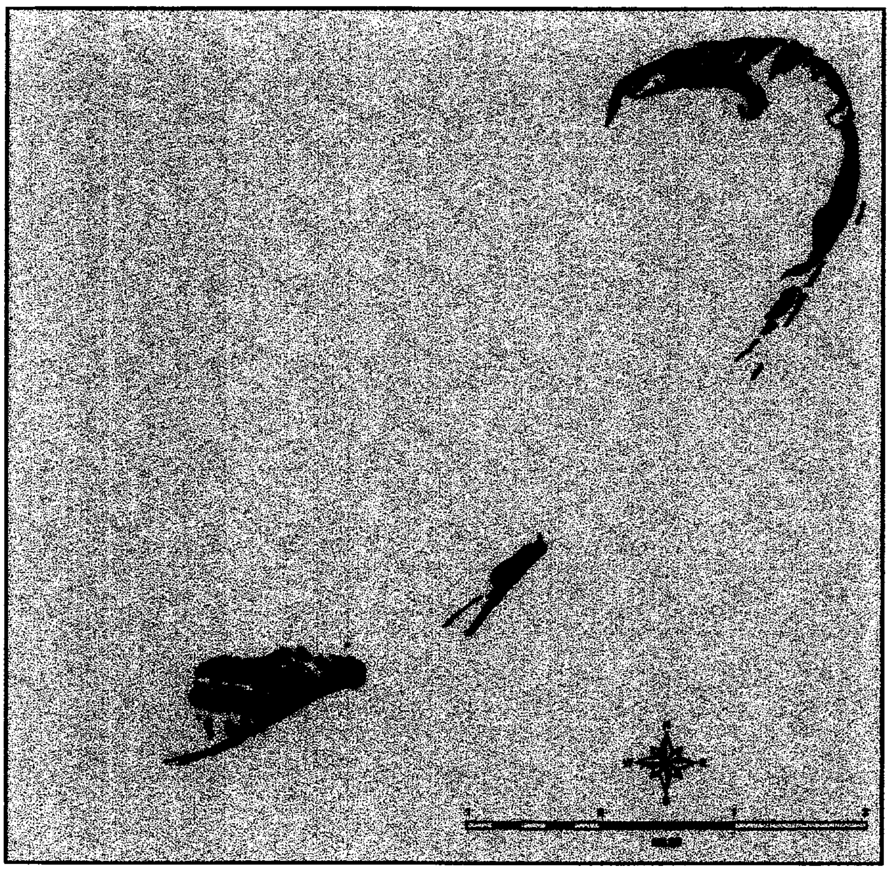
Spartina patens (Aiton) Muhl. . . . . marshhay cordgrass
rhizomatous perennial; brackish marsh, low dunes, sand flats

U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE MONITORING PROGRAM
1996 ANNUAL REPORT

Part 4: Results of Monitoring the Beneficial Use of Dredged Material at MRGO - Breton Island.

Base Year 1985 thru Fiscal Year 1996



Shea Penland, Karen A. Westphal, Chris Zganjar, Paul Connor, and Qiang Tao
Coastal Studies Institute - Louisiana State University
Baton Rouge, LA 70803

and

Linda Mathies, Beth Nord, and Robert Gunn
Operations Division - Technical Support Branch (CELMN-OD-T)
U.S. Army Corps of Engineers - New Orleans District
New Orleans, LA 70160-0267

Baton Rouge, Louisiana
1997

TABLE OF CONTENTS

INTRODUCTION 4-1

NAVIGATION CHANNEL AND DREDGED MATERIAL DISPOSAL HISTORY 4-5

FIELD SURVEY RESULTS 4-6
  Elevation Profile Surveys 4-6
  Vegetative Character 4-6

GIS ANALYSIS 4-7
  Long-term Shoreline Change History: 1869-1985 4-7
  BUMP Analysis: 1985-1996 4-10
    Area Change 4-10
    Linear Change 4-15

CONCLUSIONS 4-18

REFERENCES 4-18

APPENDIX 4A 4-19

LIST OF FIGURES

Figure 1. Location map of the Mississippi River Gulf Outlet (MRGO) - Breton Island BUMP study area in Louisiana. 4-1

Figure 2. The location of the beneficial use of dredged material offshore feeder berm in relation to Breton Island. 4-3

Figure 3. Location of the MRGO - Breton Island dredged material BUMP study area. The minimum limits of the air photo mosaics and the area digitized are presented. . . . 4-4

Figure 4. Profile BRET-03 obtained on May 17, 1995 from the MRGO-Breton Island BUMP study area with vegetative communities added. 4-6

Figure 5. Graph of the area of the BUMP Breton Island study area over time. Data for 1869, 1922, 1951, 1978, and 1989 from McBride, et al. 1992. Data for 1985, 1995, and 1996 are from the USACE-NOD dredged material BUMP. 4-7

Figure 6. The land loss and land gain history of Breton Island between 1869 and 1985 (Source: 1869 shoreline - McBride, et al. 1992; 1985 shoreline - BUMP). 4-8

Figure 7. The 1869 and 1985 shorelines with the same transect lines used in McBride, et al. (1992) to calculate linear shoreline change data. 4-9

Figure 8. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing December 1985 and November 1996. 4-11

Figure 9. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing December 1985 and April 1995. 4-12

Figure 10. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing April 1995 and November 1995 4-13

Figure 11. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing November 1995 and November 1996. 4-14

Figure 12. The December 1985, January 1989, April 1995, and November 1996 shorelines with the same transect lines used in figure 7 to calculate linear shoreline change data. 4-16

Figure 13. The December 1985, January 1989, April 1995 and November 1996 shorelines in relation to the position of the pilot berm. 4-17

Figure 14. Oblique aerial photograph of Breton Island taken on July 29, 1994 showing the large beach protuberance immediately adjacent to the pilot berm. The view is to the south. 4-17

LIST OF TABLES

TABLE 1
Breton Island area: 1869-1996 4-8

TABLE 2
Breton Island Shoreline Change: 1869-1985 4-9

TABLE 3
Breton Island Area Change: 1985-1996 4-10

TABLE 4
Breton Island Shoreline Change: 1985-1996 4-15

INTRODUCTION

Breton Island is the southernmost island of the Chandeleur transgressive barrier island arc and is located on the southern side of the Mississippi River Gulf Outlet (MRGO) navigation channel that passes through Breton Sound on its way to the Gulf of Mexico (Figure 1). Breton Island is composed of sands derived from the abandoned St. Bernard delta complex. Beach ridges, recurved spits, and washover fans make up the landscape of Breton Island. This island is plagued by high rates of erosion and land loss. Breton Island is part of the Breton Island National Wildlife Refuge.

The Beneficial Use Monitoring Program (BUMP) at Louisiana State University - Coastal Studies Institute (LSU-CSI) is documenting the beneficial use of dredged material using aerial photography, geographical information system (GIS) analysis, and field surveys through the sponsorship of the US Army Corps of Engineers - New Orleans District (USACE-NOD). The techniques and methodology used in the current BUMP analysis is explained in Penland and Westphal (1996). BUMP results are provided in map series, annual reports, and scientific literature.

This is an updated report, building on information that was reported at the 1997 Dredging Conference held in May of 1996.

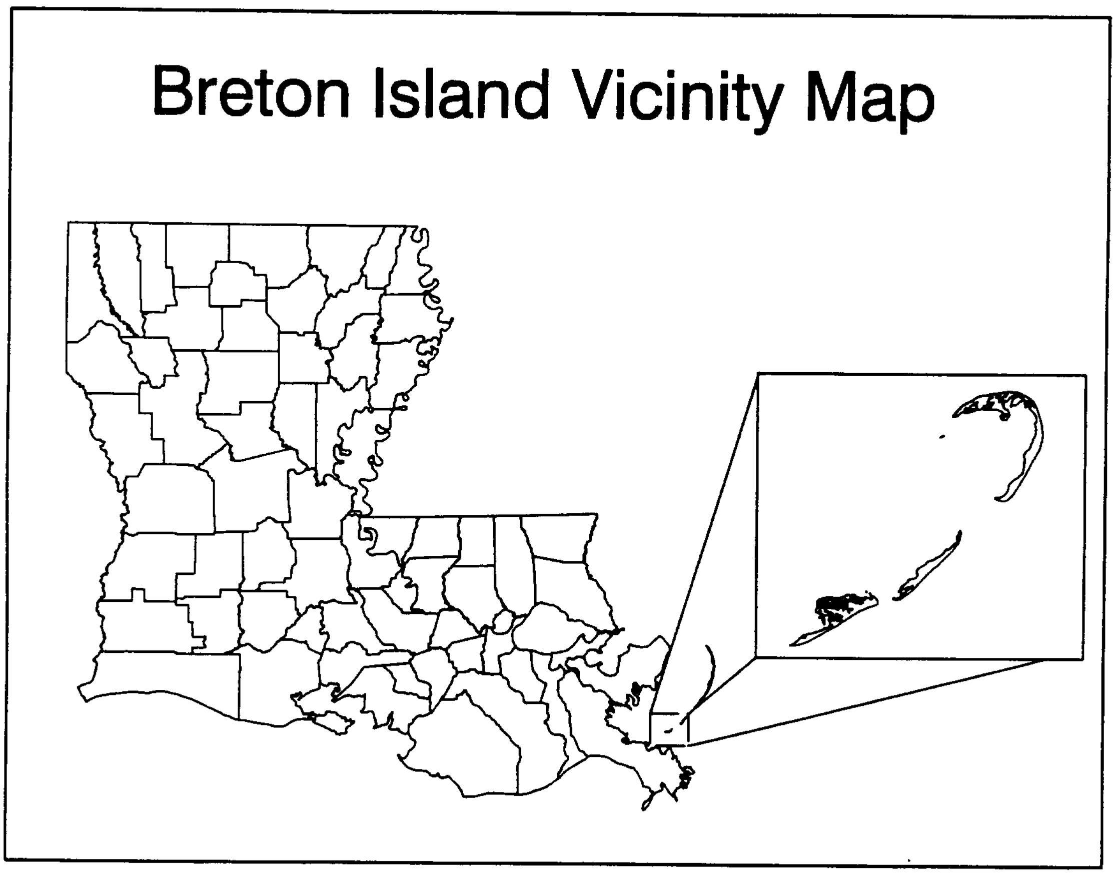


Figure 1. Location map of the Mississippi River Gulf Outlet (MRGO) - Breton Island BUMP study area in Louisiana.

In this report, LSU presents the data acquired through the Beneficial Use of Dredged Materials Program (BUMP) during Year 2 for MRGO - Breton Island. This is the fourth section of the nine part BUMP Year 2, 1996 Annual Report. The nine parts are:

Part 1: Introduction and Methodology

Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59

Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties

Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island

Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou

Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass

Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Canal, Louisiana - Bay Chaland

Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe

Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Breton Island is being monitored to by the dredged material BUMP to determine the benefits of an offshore feeder berm to the adjacent shoreline. Breton Island is suffering from shoreline erosion rates in excess of 100 ft/yr and land loss rates of 6 acres/yr. The Breton Island feeder berm has two goals: shoreline nourishment and wave protection. The potential exists for onshore/longshore sediment transport from the feeder berm to nourish Breton Island and slow or halt the rate of shoreline erosion. The second benefit of the feeder berm is to potentially reduce and alter the nearshore wave climate in such a manner as to reduce or locally reverse shoreline erosion. Figure 2 shows the location of the Breton Island feeder berm and the MRGO channel.

Using vertical aerial photography, LSU produced shoreline maps for December 1990, April 1995, November 1995, and November 1996. In May 1995, transects were established on Breton Island and elevation and vegetation profile data were obtained. In August 1996, transects were revisited, and new transects added, but no new elevation profile data were obtained. Figure 3 shows the limits of the BUMP study site, including the minimum area of coverage of the aerial photography and the area digitized.

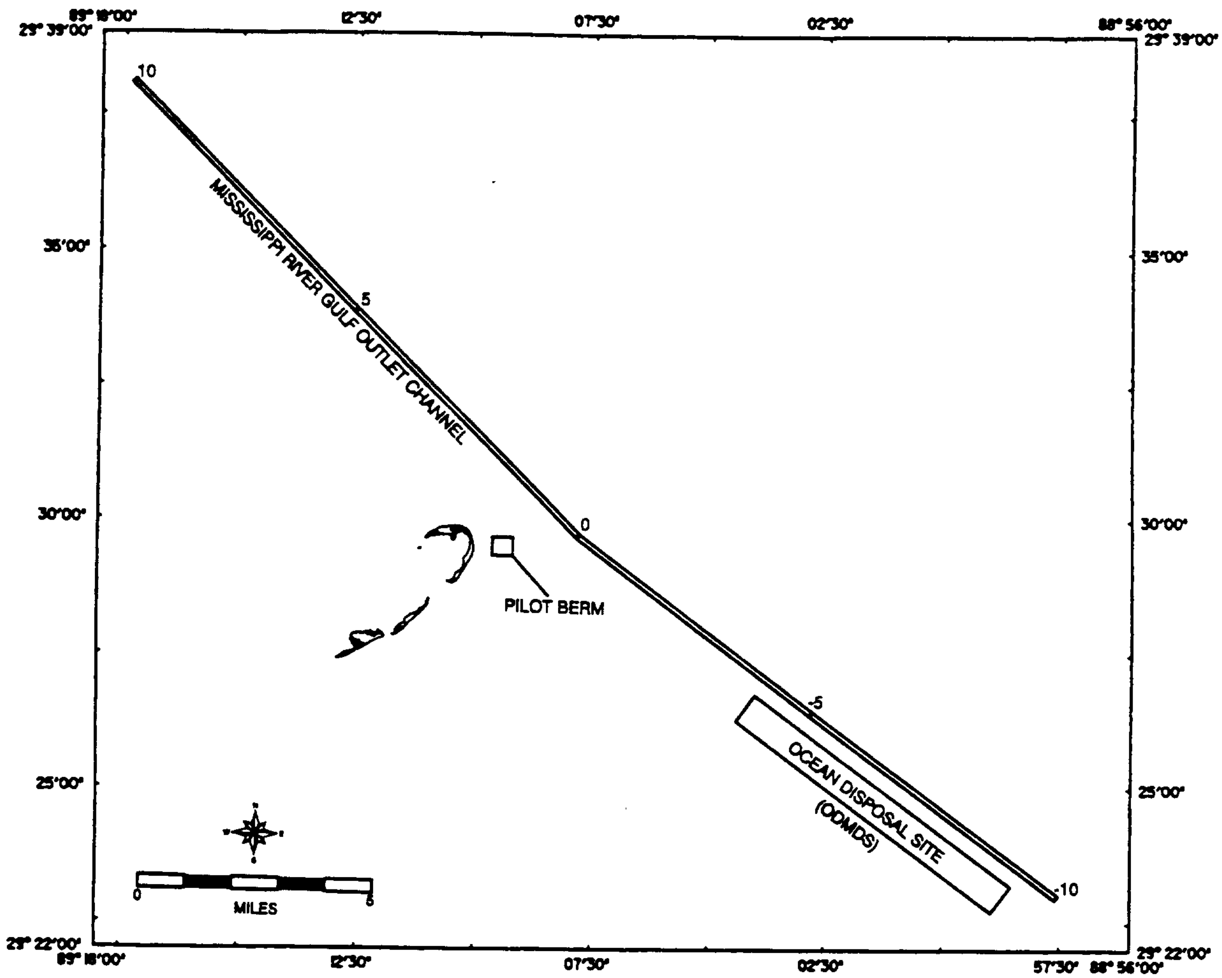


Figure 2. The location of the beneficial use of dredged material offshore feeder berm in relation to Breton Island.

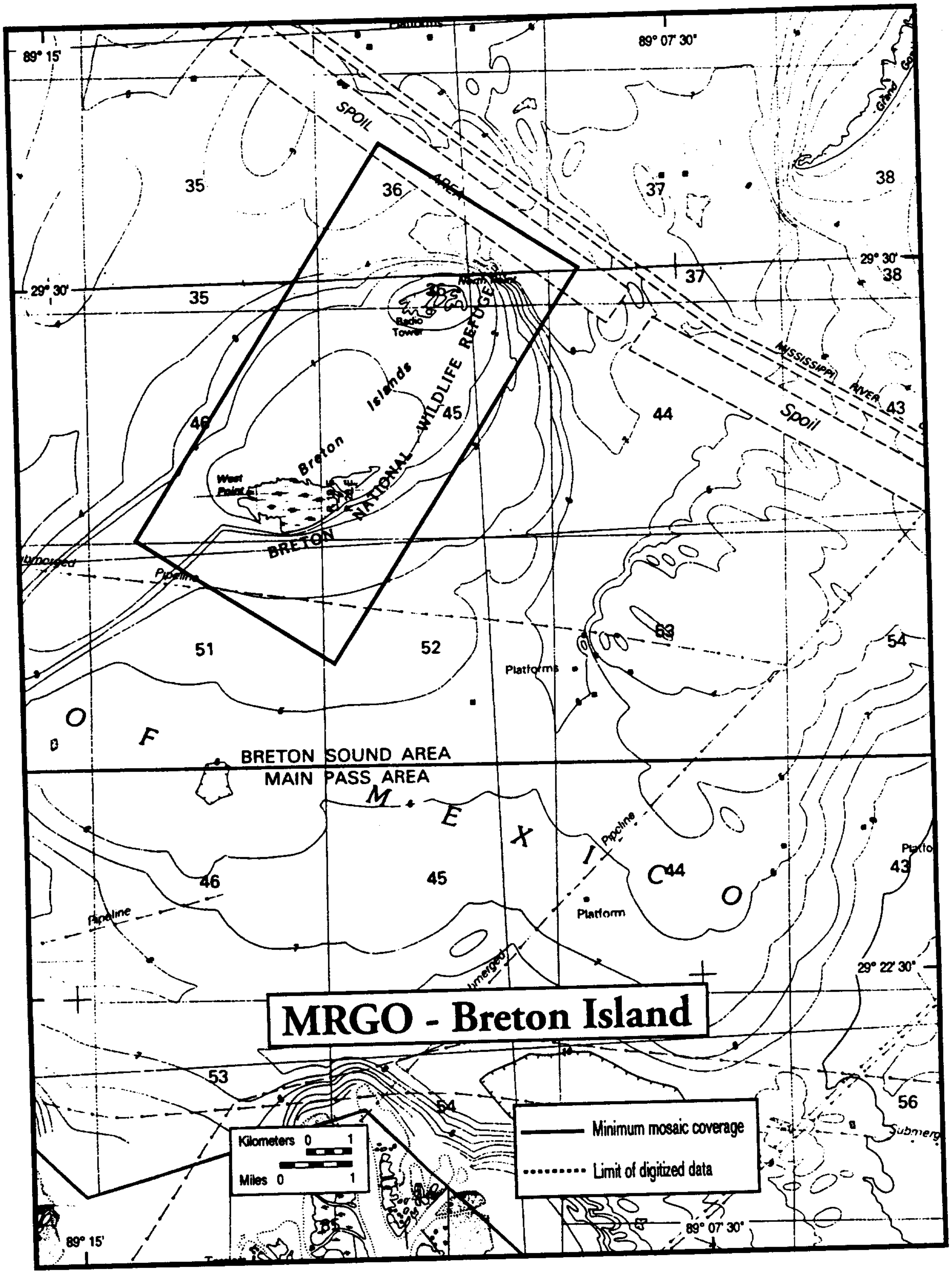


Figure 3. Location of the MRGO - Breton Island dredged material BUMP study area. The minimum limits of the air photo mosaics and the area digitized are presented.

NAVIGATION CHANNEL AND DREDGED MATERIAL DISPOSAL HISTORY

The Rivers and Harbors Act of 1956 authorized the USACE-NOD to construct and maintain a deep-draft navigation channel 36 feet deep by 500 feet wide from the Inner Harbor Navigation Canal in New Orleans to the Chandeleur Islands (Mile 66.0 to Mile 0) and a channel 38 feet deep by 600 feet side from the islands to the 38-foot contour in the Gulf of Mexico (Mile 0 to Mile -9.0). Construction of the Mississippi River Gulf Outlet (MRGO) channel was initiated in 1958 and enlargement to full project dimensions was completed in 1968. Maintenance of discontinuous reaches of the channel has been accomplished on an annual basis since construction was completed.

Historically, shoal material from the bar channel (Mile) to Mile 9.0) was removed by hopper dredges and placed into an Environmental Protection Agency designated ocean dredged material disposal site (ODMDS) located southwest of the navigation channel. During annual coordination prior to the Fiscal Year 1992 maintenance event, the Louisiana Department of Natural Resources (DNR) asked USACE-NOD) to investigate the feasibility of berm construction with dredged material from the MRGO bar channel. According to DNR, construction of a berm adjacent to Breton Island could nourish and /or protect the island from continued erosion.

Scientists from the USACE Waterways Experiment Station's Coastal Engineering Resource Center (CERC) assisted USACE-NOD with development of a plan to construct and monitor a near shore berm. CERC recommended construction of a *pilot* near shore berm 1) To determine the constructability of a berm using a hydraulic cutterhead pipeline dredge; 2) to investigate the mounding potential of the extremely fine-grained dredged material; and 3) to monitor dispersion of the berm. Little, if any, experience existed for constructing a near shore berm by hydraulic pipeline using such fine-grained material. Therefore, experience gained form constructing and monitoring the pilot near shore berm would be used to assess the feasibility of a larger berm to benefit Breton Island.

USACE-NOD determined the dredged material placement location and approximate configuration with guidance form CERC. Monitoring consisted of pre- and post-construction hydrographic surveys, seabed drifter studies, sediment sampling, dredging operations inspection and documentation, and data analysis.

Approximately 1.7 million cubic yards of dredged material from the Mile 0 to Mile -2.5 reach of the MRGO bar channel was placed at the pilot near shore berm location in September, 1992. Post-construction surveys revealed that approximately 400,000 cubic yards of the dredged material placed at the pilot near shore berm site remained in a mound at the site following construction.

FIELD SURVEY RESULTS

Elevation Profile Surveys

In May of 1995, profile transects were established and surveys were conducted along four transects. Storm surges removed the original benchmarks during the summer of 1995 and winter of 1996. The field effort in 1996 consisted of re-establishing old sites and establishing a few additional sites. However, because of events beyond our control, no elevation data was ever acquired during 1996. Figure 4 is an elevation profile from 1995 that is included as an example of conditions on Breton Island.

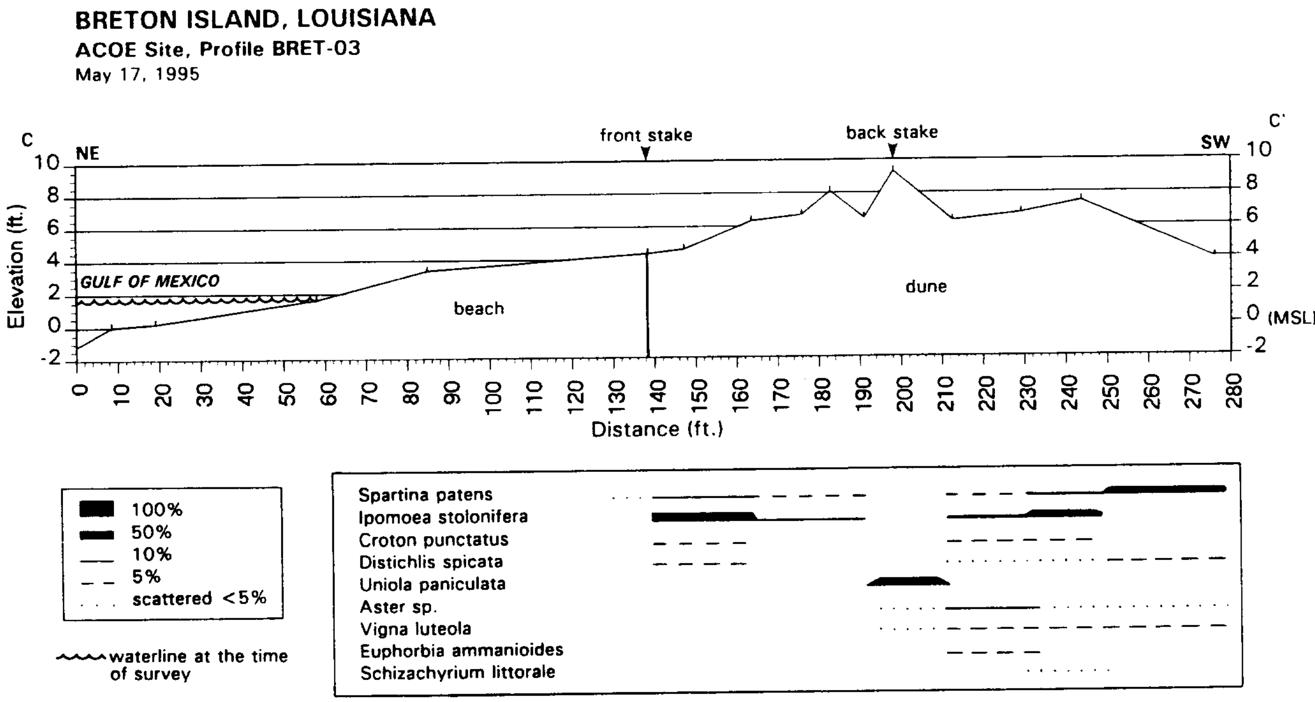


Figure 4. Profile BRET-03 obtained on May 17, 1995 from the MRGO-Breton Island BUMP study area with vegetative communities added.

Vegetative Character

The overall marsh type for this area would be classified as salt marsh represented by *Spartina alterniflora*. The other vegetative habitats found at this site were dune zones of *Spartina patens* or *Uniola paniculata*; barrier island shrub/scrub zones of *Myrica cerifera*, *Baccharis halimifolia*, and *Sesbania drummondii*; and high marsh or upland-grassland dominated by *Spartina patens*. All habitats are considered natural except for the part within the Kerr Magee facility. A brief species list of this area is included in Appendix A.

GIS ANALYSIS

Long-term Shoreline Change History: 1869-1985

Figure 5 graphs the spatial history of the study area between 1869 and 1996 based on data from the U.S. Geological Survey - Louisiana Barrier Island Erosion Study: Atlas of Shoreline Changes, which was updated by the BUMP (Table 1). The study area in 1869 was measured at 820.4 acres and in 1985 it was measured at 252.1 acres. This is an area decrease of -568.2 acres and an average long-term area decrease of -4.9 acres per year.

Breton Island decreased in area between 1869 and 1922 by -669.7 acres or 18 percent. The average rate of change between 1869 and 1922 was -2.97 acres/yr. In contrast, by 1951, the island area expanded to +719.1 acres at a rate of +1.73 acres/yr. During the period 1951 to 1978, this trend reversed and Breton Island experienced a great amount of area loss. Island area was reduced by 52 percent, with a loss of -370.7 acres at a rate of -13.3 acres/yr. In 1985, Breton Island measured 252.1 acres, which is a decrease of -96 acres since 1978 at a rate of -13.7 acres per year. Breton Island's central area was breached by the 1985 hurricanes, leaving two resistant ends that experienced limited change.

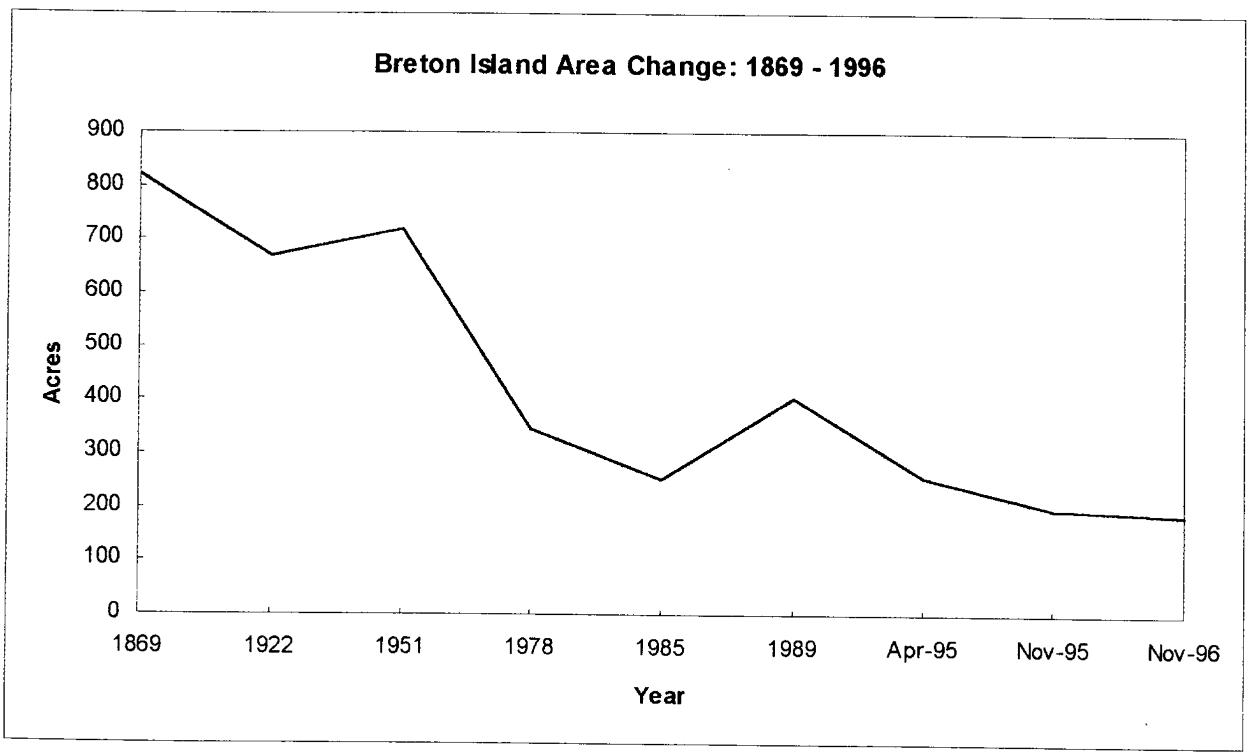


Figure 5. Graph of the area of the BUMP Breton Island study area over time. Data for 1869, 1922, 1951, 1978, and 1989 from McBride, et al. 1992. Data for 1985, 1995, and 1996 are from the USACE-NOD dredged material BUMP.

TABLE 1
Breton Island area: 1869-1996

Year	1869[1]	1922[1]	1951[1]	1978[1]	1985*	1989[1]	April 1995*	Nov 1995*	Nov 1996*
Area in Acres	820.4	669.7	719.1	348.4	252.1	405.3	257.3	199.9	179.9

[1]From McBride, et al., 1992.
*BUMP data

Figure 6 depicts the land loss and land gain history for Breton island between 1869 and 1985. The average rate of shoreline erosion at Breton Island is -19.5 feet per year for the period of 1869 to 1985. Figure 7 shows the 1869 and 1985 shorelines with the same transect lines as those used in the USGS barrier island atlas to calculate linear shoreline change data. Table 2 lists the individual shoreline change statistics for this time period.

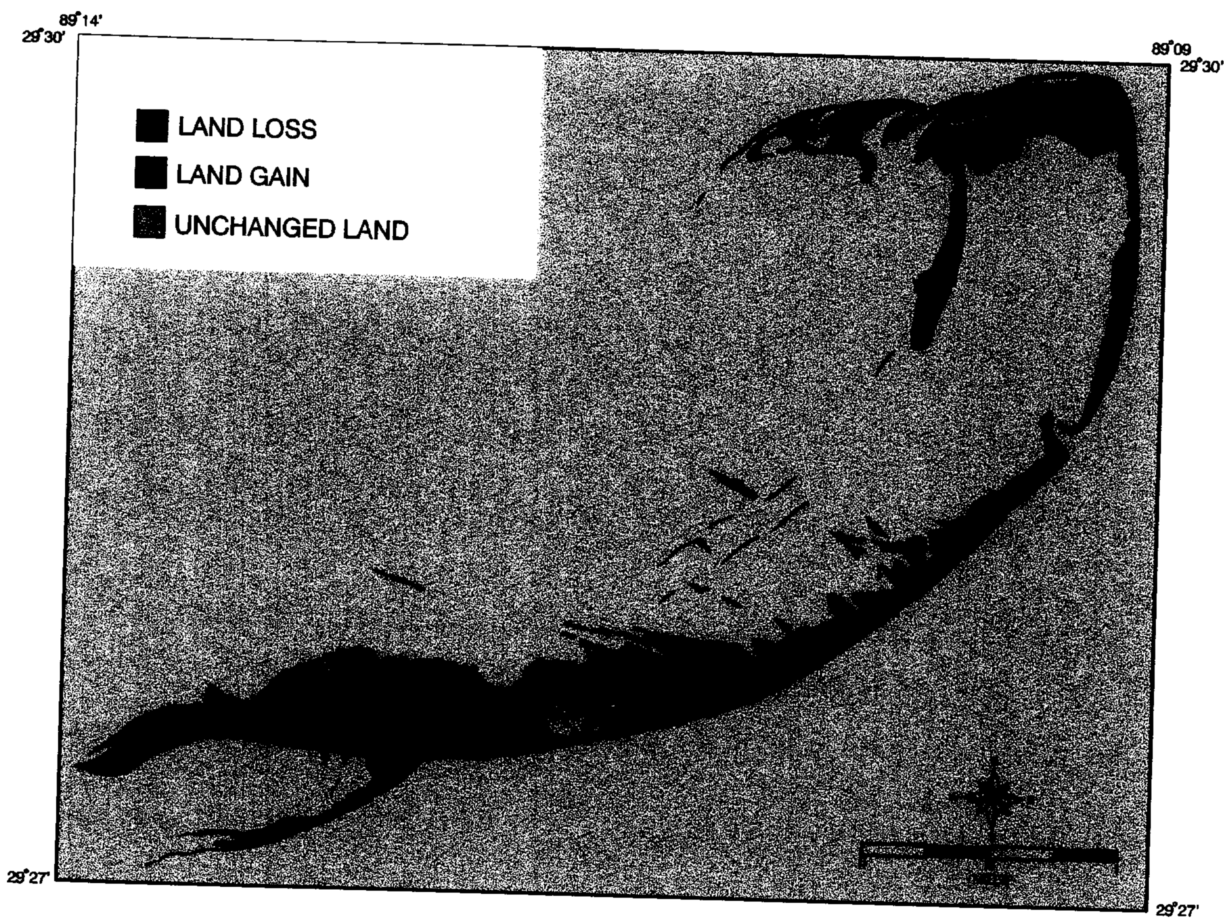


Figure 6. The land loss and land gain history of Breton Island between 1869 and 1985 (Source: 1869 shoreline - McBride, et al. 1992; 1985 shoreline - BUMP).

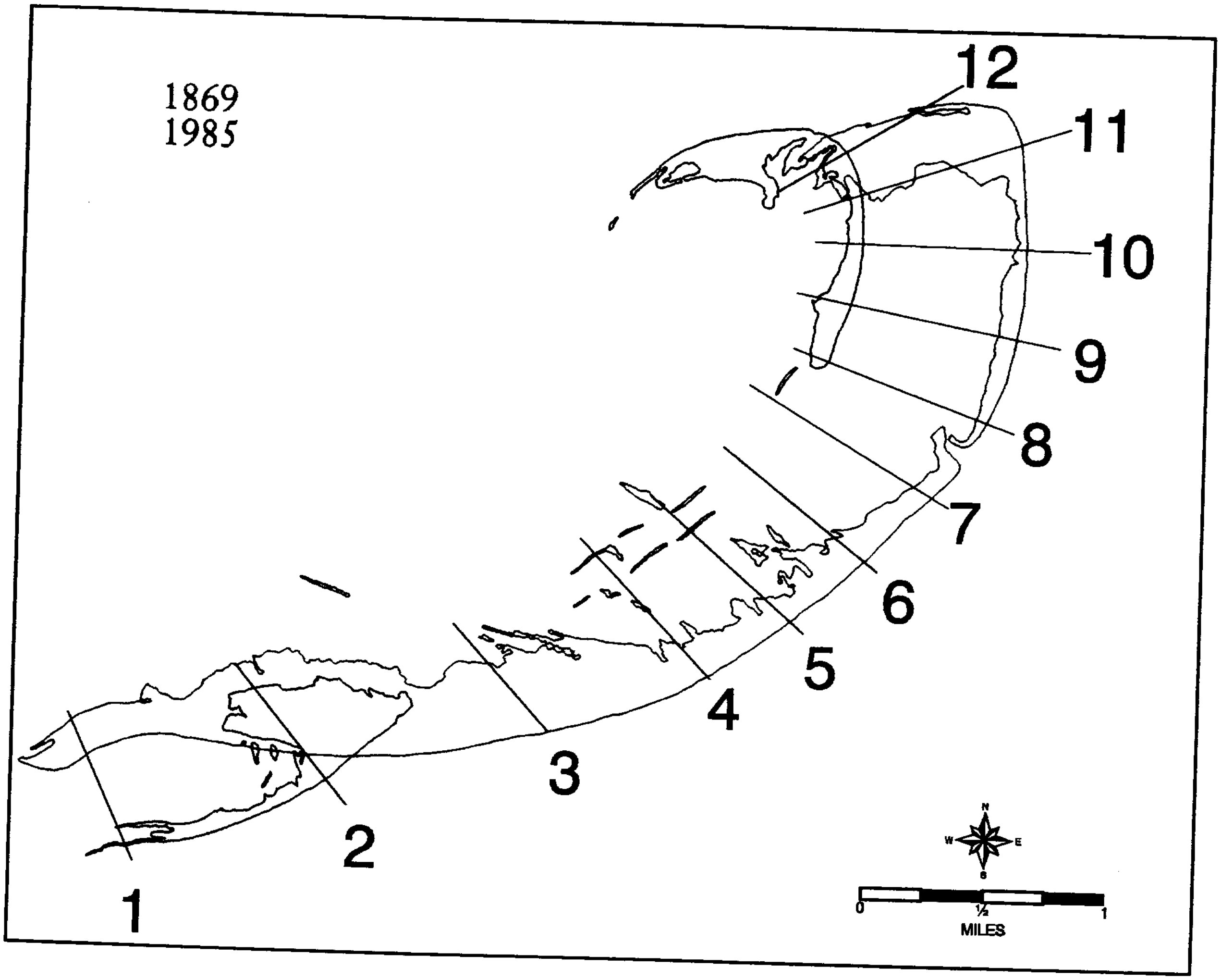


Figure 7. The 1869 and 1985 shorelines with the same transect lines used in McBride, et al. (1992) to calculate linear shoreline change data.

TABLE 2
Breton Island Shoreline Change: 1869-1985

Transect #	1	2	3	4	5	6	7	8	9	10	11	12	Total Average
Shoreline Change (feet)	+2112	+662	--	-3588	-2916	--	--	-3692	-3690	-3568	-3655	-2013	-2260.9
Rate of Change (ft/yr)	+18.2	+5.7	--	-30.9	-25.1	--	--	-31.8	-31.8	-30.8	-31.5	-17.4	-19.5

BUMP Analysis: 1985-1996

Area Change

The benchmark year for the dredged material BUMP is 1985. The first monitoring year for MRGO-Breton Island is April 1996. The digital January 1989 shoreline from McBride et al. is used to improve the resolution of the BUMP analysis. Table 3 depicts the change in total area of Breton Island and Figure 8 shows the trends of land loss and land gain between December 1985 and November 1996. There was an overall loss of -72.2 acres at a rate of -6.6 acres per year during this 10.9-year time period.

Figure 9 shows the areas of land loss and land gain between December 1985 and April 1995. In December 1985, the area of Breton Island was measured at 252.1 acres. By January 1989, the area of Breton Island increased to 405.3 acres. This is an increase of +153.2 acres at a rate of +49.7 acres per year which is attributed to barrier island recovery processes following the 1985 hurricanes. Between 1985 and 1989, the breach through the central part of Breton Island infilled and shoaled to form a broad washover terrace upon which a hummocky dune field was established. Between January 1989 and April 1995, Breton Island experienced another erosional period due to storm surges from hurricanes Gilbert and Florence in 1989, Hurricane Andrew in 1992 and numerous other storms. In April 1995, Breton Island was measured at 257.3 acres which represented a decrease of -148 acres at a rate of -23.7 acres per year.

Figure 10 shows the areas of land loss and land gain between April 1995 and November 1995. In November 1995, Breton Island was measured at 199.9 acres (Table 1). There was an overall loss of -57.4 acres at a rate of -98.4 acres per year during this eleven month time period. The loss occurred predominately along the Gulf shoreline including much of the mid-island shoal and because of breaches formed in narrow parts of the island. This was offset by a small amount of accretion on the inner shoreline of the island and spit elongation.

Figure 11 shows the areas of land loss and land gain between November 1995 and November 1996. In November 1996, Breton Island was measured at 179.9 acres (Table 1). There was an overall loss of -20.0 acres during this one year time period. Breaches widened and Gulf shore erosion continued.

TABLE 3
Breton Island Area Change: 1985-1996

Period	Area Change (acres)	Rate of Change (acres/yr)
Dec 1985 - Jan 1989	+153.2	+49.7
Jan 1989 - Apr 1995	-148.0	-23.7
Apr 1995 - Nov 1995	-57.4	-98.4
Nov 1995 - Nov 1996	-20.0	-20.0
Dec 1985 - Nov 1996	-72.2	-6.6

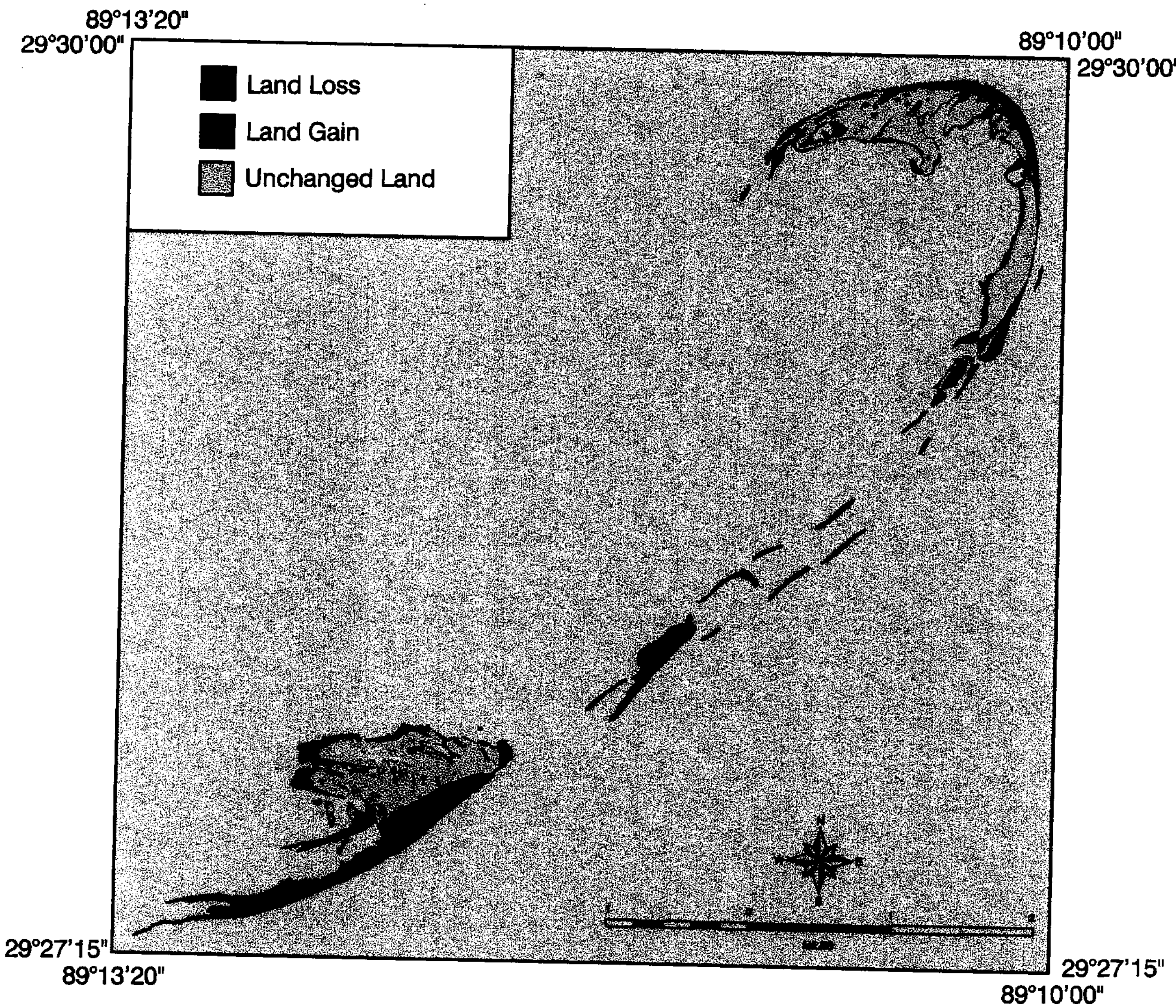


Figure 8. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing December 1985 and November 1996.

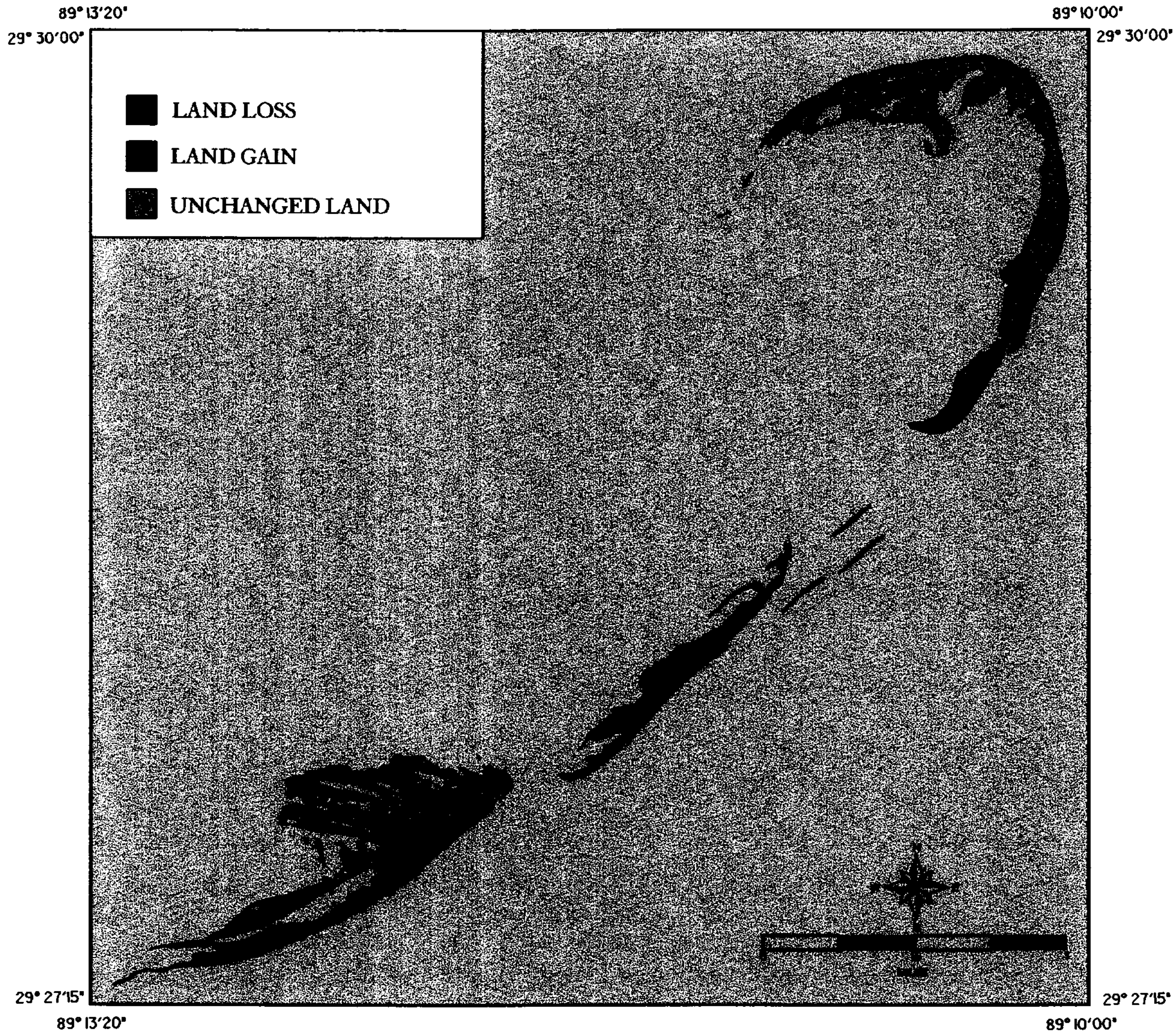


Figure 9. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing December 1985 and April 1995.

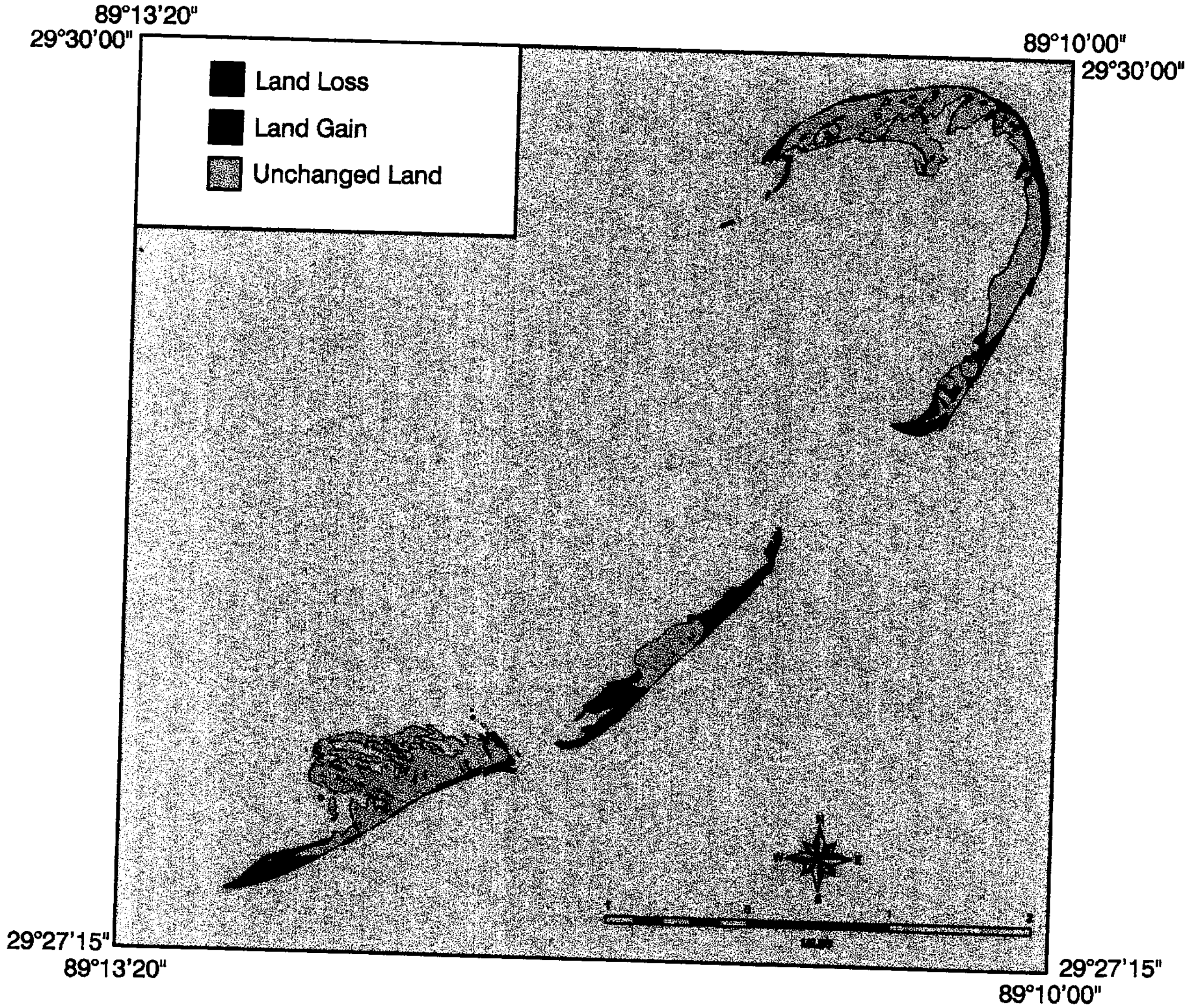


Figure 10. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing April 1995 and November 1995.

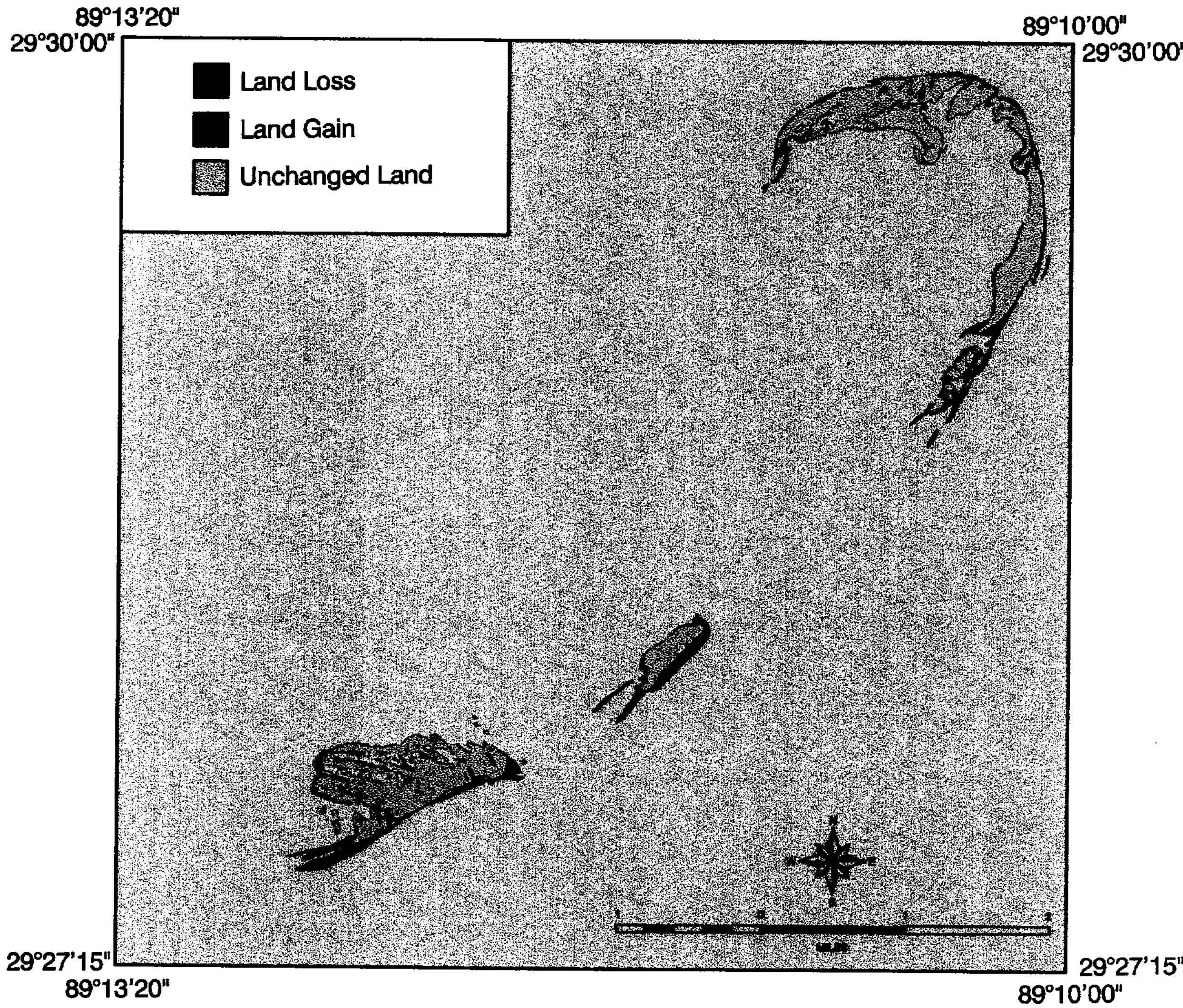


Figure 11. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing November 1995 and November 1996.

Linear Change

Figure 12 shows the same shoreline change transects as those used in the USGS barrier island atlas, and table 4 lists the individual shoreline change statistics for December 1985, January 1989, April 1995, November 1995, and November 1996. The Gulf of Mexico shoreline prograded an average of +126.1 feet between 1985 and 1989 at a rate of +40.9 feet per year. There were areas of significant shoreline gain in the central portions of Breton Island where hurricane recovery processes rebuilt the island. Between January 1989 and April 1995, the Gulf of Mexico eroded an average of -145.9 feet at a rate of -23.3 feet per year. The seven month period between April 1995 and November 1995 showed the highest rate of erosion isolated in this study with an average retreat of -163.9 feet per transect line for an average rate of -281.0 feet per year. In contrast, the next period of measurement between November 1995 and November 1996 showed an overall average rate of increase as +5.3 feet for the year. The average amount of shoreline change for the entire BUMP analysis between December 1985 and November 1996 is a retreat of -298.1 feet at a rate of -27.3 feet per year.

An interesting pattern of shoreline change was recognized during the BUMP analysis period. In the areas immediate adjacent to the pilot berm, transects 9 ant 10 showed significant shoreline progradation when adjacent areas experienced erosion between 1985 and April 1995 (Figure 8) and less erosion than other areas during other periods. Figure 12 shows an enlargement of this area and its proximity to the pilot berm. The unpublished drifter study by the USACE-NOD shows significant onshore movement of the drifters from the pilot berm area to the Breton Island shorelines. The aerial photograph in Figure 20 shows the large beach protuberance in 1994 immediately adjacent to the pilot berm.

TABLE 4
Breton Island Shoreline Change: 1985-1996

Transect #	1	2	3	4	5	6	7	8	9	10	11	12	Average
1985-1989 Shoreline Change (feet)	+159	-221	--	+831	-76	--	--	+74	+119	+130	+97	+22	+126.1
1985-1989 Rate of Change (ft/yr)	+51.6	-71.8	--	+269.8	-24.7	--	--	+24.0	+38.6	+42.2	+31.5	+7.1	+40.9
1989-Apr 1995 Shoreline Change (feet)	--	-343	+261	-355	--	--	-254	-251	-98	+5	-120	-158	-145.9
1989-Apr 1995 Rate of Change (ft/yr)	--	-54.9	+41.8	-56.8	--	--	-40.6	-40.2	-15.7	+0.8	-19.2	-25.3	-23.3
Apr 1995-Nov 1995 Shoreline Change (feet)	--	-33	-602	-252	--	--	-20	-230	+56	-163	-159	-72	-163.9
Apr 1995-Nov 1995 Rate of Change (ft/yr)	--	-56.6	-1032.0	-432.0	--	--	-34.3	-394.3	+96.0	-279.4	-272.6	-123.4	-281.0
Nov 1995-Nov 1996 Shoreline Change (feet)	--	-66	+85	--	--	--	-28	+186	-101	-17	+60	-77	+5.3
Nov 1995-Nov 1996 Rate of Change (ft/yr)	--	-66	+85	--	--	--	-28	+186	-101	-17	+60	-77	+5.3
1985- 1996 Shoreline Change (feet)	--	-663	--	-729	--	--	--	-220	-24	-45	-120	-286	-298.1
1985- 1996 Rate of Change (ft/yr)	--	-60.7	--	-66.8	--	--	--	-20.2	-2.2	-4.1	-11.0	-26.2	-27.3

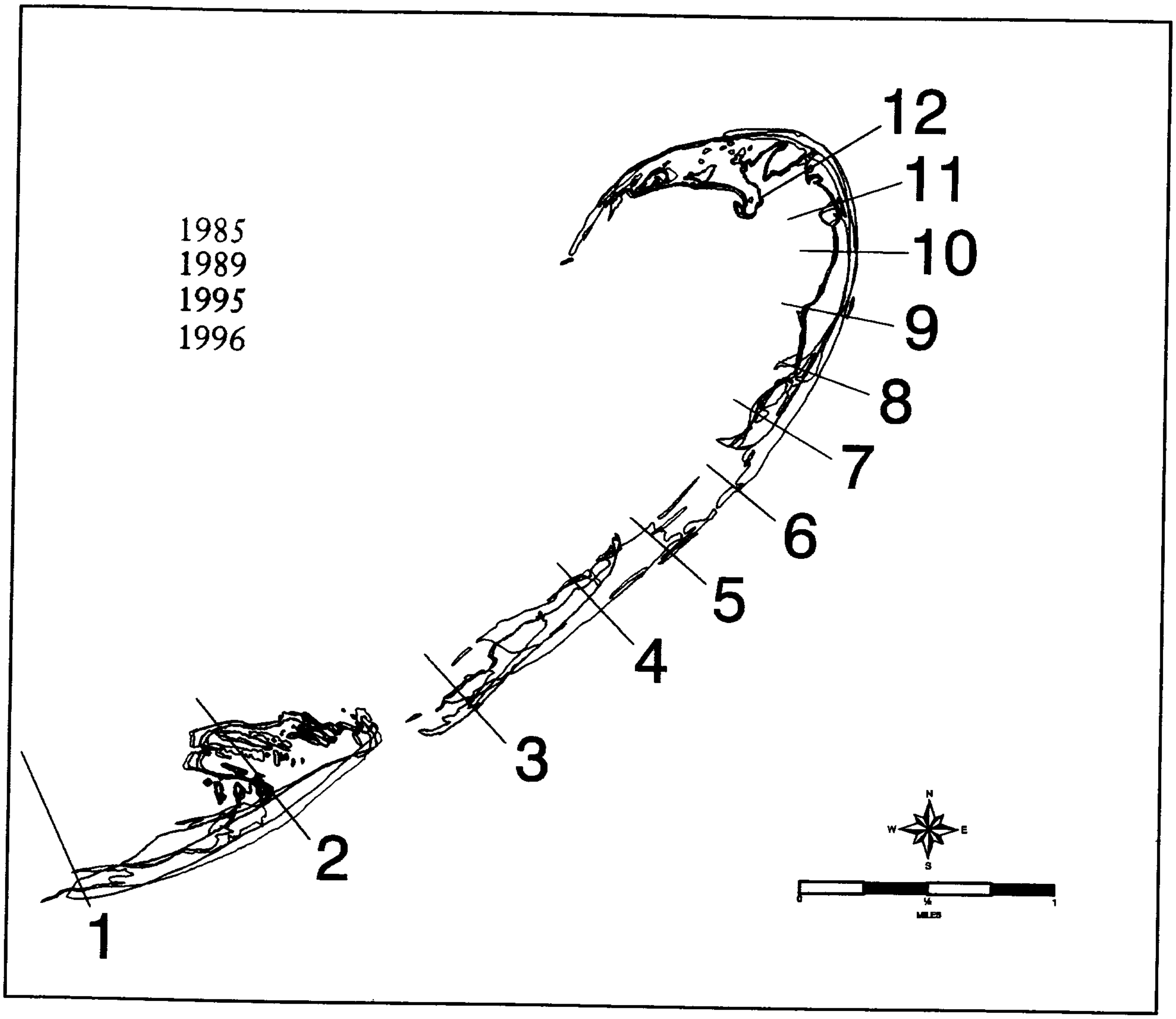


Figure 12. The December 1985, January 1989, April 1995, and November 1996 shorelines with the same transect lines used in figure 7 to calculate linear shoreline change data.

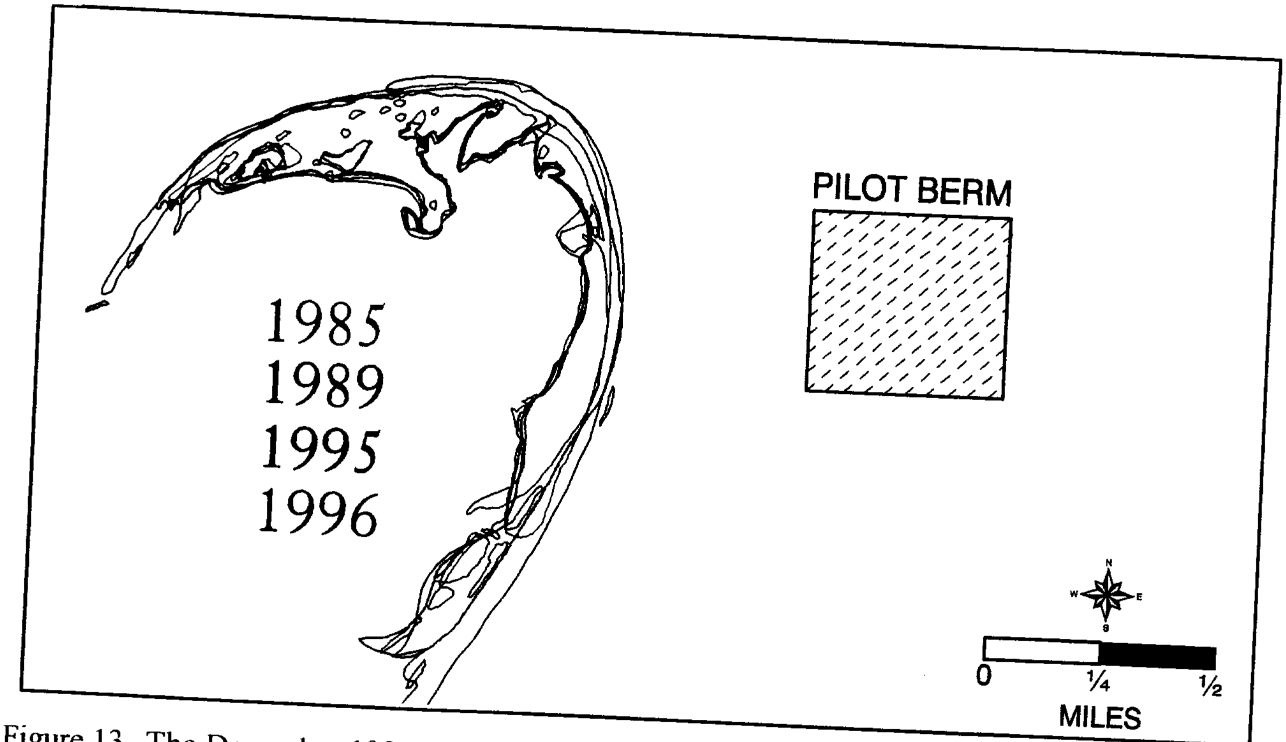


Figure 13. The December 1985, January 1989, April 1995 and November 1996 shorelines in relation to the position of the pilot berm.

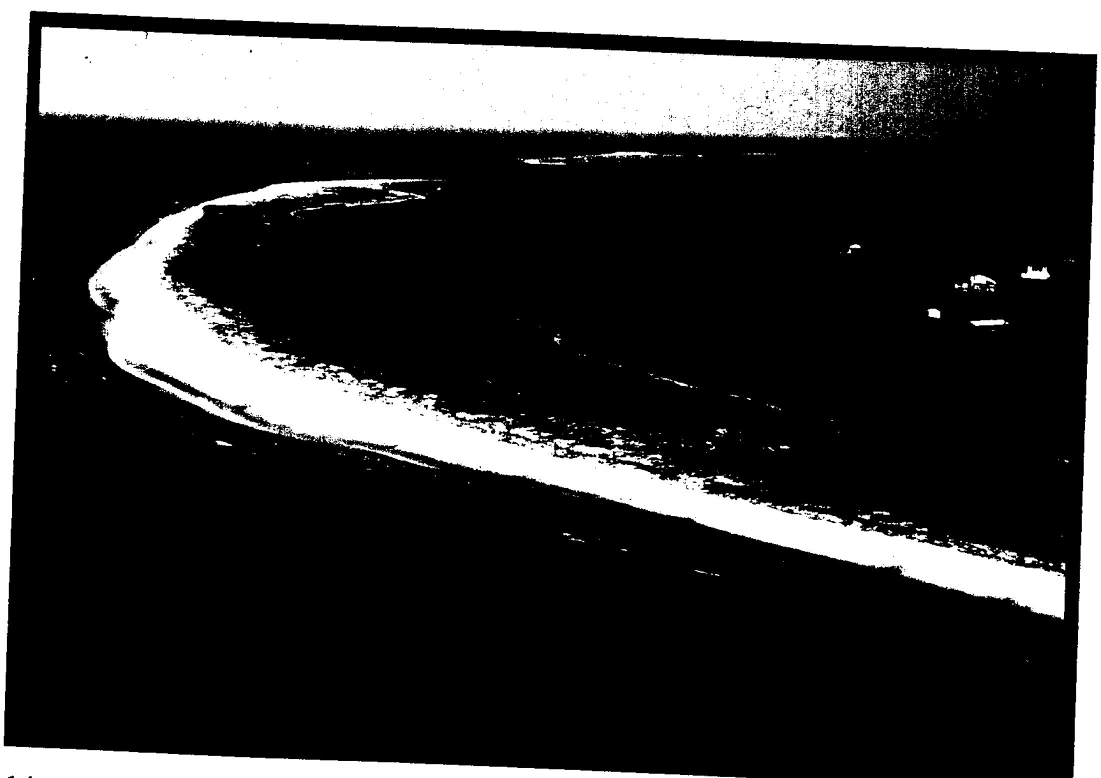


Figure 14. Oblique aerial photograph of Breton Island taken on July 29, 1994 showing the large beach protuberance immediately adjacent to the pilot berm. The view is to the south.

CONCLUSIONS

1. The BUMP baseline documented that Breton Island is experiencing rapid erosion and land loss. Between 1869 and 1985 Breton Island decreased in area -568.2 acres at a rate of -4.9 acres per year. The average rate of shoreline change for this period was -19.5 feet per year.

2. During the BUMP monitoring period of 1985-1996, Breton Island recovered from the impacts of the 1985 hurricanes as evidenced by the +153.2 acre area increase by 1989. Since 1989, Breton Island lost -225.4 acres of land to the impact of Hurricane Andrew in 1992 and other storms during this time period

3. The USACE-NOD built a pilot berm in 1993. Along the shoreline immediately adjacent to the pilot berm, a large beach protuberance developed after 1993. Measurements indicate that the shoreline of the protuberance accreted +56 feet between April 1995 and November 1995 while the adjacent shoreline eroded more than -163 feet, and between November 1995 and November 1996, an area just down-drift of the protuberance area accreted +186 feet.

REFERENCES

McBride, R.A., Penland, S., Hiland, M.W., Williams, S.J., Westphal,K.A., Jaffe,B.E., Sallenger,A.H., 1992. Analysis of barrier shoreline change in Louisiana from 1853 to 1989. Chapter in: Louisiana Barrier Island Erosion Study - Atlas of Shoreline Changes in Louisiana from 1853 to 1989; Williams, S.J., Penland, S., and Sallenger, A.H. Editors. U.S. Geological Survey Miscellaneous Investigation Series I-2150-A, p. 36-97.

APPENDIX 4A

LIST OF VEGETATIVE SPECIES IN THE MISSISSIPPI RIVER GULF OUTLET - BRETON ISLAND

LIST OF VEGETATIVE SPECIES
IN THE MISSISSIPPI RIVER GULF OUTLET -BRETON ISLAND

An alphabetical list of observed and collected plant species follows. This list is not complete, but is meant to establish vegetative character and indicate dominant species observed. The list includes the species name, alternate scientific names, common names, and general habitat description for each plant. The habitat information was taken from the Manual of the Vascular Flora of the Carolinas or The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts.

Aster tenuifolius L. . . . . perennialsaltmarshaster
perennial; salt and brackish marshes

Baccharis halimifolia L. . . . . groundselbush
shrub; elevated sites in fresh to saline marshes

Borrichia frutescens (L.) . . . . sea ox-eye
shrub; brackish marsh or upper elevations of salt marsh

Cakile geniculata . . . . sea rocket
succulent annual; coastal sand dunes, overwash areas, sand flats

Calystegia sepium (L.) Brown . . . . hedge bindweed
twining vine; fields, roadsides and waste places

Cenchrus tribuloides L. . . . . large sand spur
sprawling perennial; dunes, sandy fields and woods

Chloris petraea Schwartz. . . . . finger grass
tufted perennial; dunes and sand flats

Croton punctatus Jacquin. . . . . beach tea
woody, short-lived perennial; sand dunes along the coast

Cynanchum palustre (Pursh) Heller . . . . climbing milkweed vine
perennial twining herb; salt marshes and coastal hammocks

Cyperus spp. . . . . nut sedges

Distichlis spicata (L.) Greene . . . . salt grass
rhizomatous perennial; brackish marshes and flats

Eragrostis sp. . . . . love grass

Euphorbia ammanioides HBK. . . . . seaside spurge
Prostrate annual; sand dunes along the coast, sandy barrens

Ipomoea stolonifera (Cyrillo) Poiret. . . . . beach morning glory
perennial vine; beach dunes

Iva frutescens L. . . . . marsh elder
shrub; brackish marshes, upper elevations of salt marshes

Hydrocotyle bonariensis Lam. . . . . sand pennywort
prostrate, creeping perennial; among beach dunes, moist open sandy areas

Myrica cerifera L. . . . . wax myrtle
shrub or small tree; sand flats, pinelands and marshes

Paspalum vaginatum Sw. . . . . seashore paspalum
rhizomatous perennial; fresh to brackish marsh

Phragmites australis (Cav.) Trin. ex Steud. . . . . roseau cane
tall, rhizomatous, perennial reed; tidal marshes, pond margins, elevated sites in saline marshes

Salicornia bigelovii Torrey . . . . glasswort
succulent annual; saline marsh, salt flats

Schizachyrium littorale Bick. . . . . maritime bluestem
perennial; dunes, above drift lines

Sesbania drummondii (Rydb) Cory. . . . . yellow rattlebox
(Daubentonia longifolia (Cav.) DC.)
shrub; sandy soils, salt spray community, elevated areas in fresh to saline marsh, scrub pine woods

Solidago sempervirens L. . . . . seaside goldenrod
perennial; brackish marsh or saline sand

Spartina alterniflora Loisel. . . . . oyster grass
coarse perennial; salt and brackish marshes

Spartina patens (Aiton) Muhl. . . . . marsh hay cordgrass
rhizomatous perennial; brackish marsh, low dunes, sand flats

Sporobolus virginicus (L.) Kunth. . . . . coastal dropseed
creeping, rhizomatous perennial; salt or brackish marshes, overwash areas, swales, dunes, salt flats

Vigna luteola (Jacq.) Benth. . . . . deer pea
trailing or twining vine; waste places, elevated areas bordering marshes, low fields

Uniola paniculata L. . . . . sea oats
coarse, rhizomatous perennial; dunes, beaches, loose sands near seashores

U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana Baptiste Collette Bayou

Base Year 1975 through Fiscal Year 1996

Shea Penland, Karen A. Westphal, Chris Zganjar, Paul Connor, Jamie Phillippe, and Qiang Tao
Louisiana State University - Coastal Studies Institute
Baton Rouge, LA 70803

and

Linda Mathies, Beth Nord, and Robert Gunn
Operations Division - Technical Support Branch (CELMN-OD-T)
U.S. Army Corps of Engineers - New Orleans District
New Orleans, LA 70160-0267

Baton Rouge, Louisiana
1997

TABLE OF CONTENTS

INTRODUCTION 5-1

DREDGED MATERIAL DISPOSAL HISTORY 5-4

FIELD SURVEY RESULTS 5-6
Methodology 5-6
Elevation Profile Surveys 5-6
Vegetation Surveys 5-8
Profiles 5-8
Vegetative Character 5-15
General Description 5-15
Vegetative community types 5-15
Elevation and the Distribution of Vegetative Community Types 5-16

GIS ANALYSIS RESULTS 5-17
Shoreline Changes: 1976-1994 5-17
Habitat Inventory 5-26
Habitat Change 5-40

CONCLUSIONS 5-52

REFERENCES 5-53

APPENDIX 5A 5A-1

LIST OF FIGURES

Figure 1. The location of the Baptiste Collette Bayou navigation channel in Louisiana. ... 5-1

Figure 2. The Baptiste Collette Bayou BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized. 5-3

Figure 3. The dredged material disposal history for the Baptiste Collette Bayou study area, 1975 to 1996. 5-5

Figure 4. Location of the Baptiste Collette Bayou BUMP study area profile transects and the benchmark (#SNG) that was used to reference the elevation data. 5-7

Figure 5. The *Strike* profile SHI-1-1 at Shea Island comparing elevation data obtained on August 30, 1995 and August 15, 1996. 5-9

Figure 6. August 1996 *Strike* profile SHI-1-1 at Shea Island with vegetation data illustrated. 5-10

Figure 7. August 1995 *Strike* profile SHI-1-1 at Shea Island with vegetation data illustrated. 5-10

Figure 9. *1995 Strike* profile SCI-1-1 at South Chris Island with habitat data illustrated. 5-12

Figure 10. 1996 *Strike* profile SCI-1-1 at South Chris Island with vegetation data illustrated. 5-12

Figure 11. The *Strike* profile SEI-1-1 at Seal Island comparing elevation data obtained on August 30, 1955 and August 15, 1996. 5-13

Figure 12. 1995 *Strike* profile SEI-1-1 at Seal Island with habitat data illustrated. 5-14

Figure 13. 1996 *Strike* profile SEI-1-1 at Seal Island with vegetation data illustrated. 5-14

Figure 14. Graph of the area of the Baptiste Collette Bayou BUMP study area over time showing the contribution of beneficial use of dredged material. The red line graphs the total natural area excluding areas created by beneficial use of dredged materials 5-17

Figure 15. Shoreline change history for the Baptiste Collette Bayou BUMP study area between October 1975 and November 1996. 5-18

Figure 16. Shoreline change history for the Baptiste Collette Bayou BUMP study area between October 1975 and December 1985. 5-20

Figure 17. Shoreline change history for the Baptiste Collette Bayou BUMP study area between December 1985 and December 1990. 5-21

Figure 18. Shoreline change history for the Baptiste Collette Bayou BUMP study area between December 1990 and February 1993. 5-22

Figure 19. Shoreline change history for the Baptiste Collette Bayou BUMP study area between February 1993 and November 1994. 5-23

Figure 20. Shoreline change history for the Baptiste Collette Bayou BUMP study area between November 1994 and November 1995. 5-24

Figure 21. Shoreline change history for the Baptiste Collette Bayou BUMP study area between November 1995 and November 1996. 5-25

Figure 20. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in October 1975. 5-27

Figure 21. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in December 1985. 5-29

Figure 22. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in December 1990. 5-31

Figure 23. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in February 1993. 5-33

Figure 24. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in November 1994. 5-35

Figure 25. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in November 1995. 5-37

Figure 26. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in November 1996. 5-39

Figure 27. New habitats created by beneficial use of dredged materials in the Baptiste Collette Bayou BUMP study area comparing October 1975 and November 1996. 5-41

Figure 28. Time series showing the changes in total area of each habitat in the Baptiste Collette Bayou BUMP study area between October 1975 and November 1996. A) natural habitat changes. B) man-made habitat changes. 5-43

Figure 29. New habitats created as a result of the beneficial use of dredged material in the Baptiste Collette Bayou study area, shown by comparing October 1975 and December 1985. 5-46

Figure 30. New habitats created as a result of the beneficial use of dredged material in the Baptiste Collette Bayou study area, shown by comparing December 1985 and December 1990. 5-47

Figure 31. New habitats created as a result of the beneficial use of dredged material in the Baptiste Collette Bayou study area, shown by comparing December 1990 and February 1993. 5-48

Figure 32. New habitats created as a result of the beneficial use of dredged material FY93 and FY94 maintenance events in the Baptiste Collette Bayou study area, shown by comparing February 1993 and November 1994. 5-49

Figure 33. New habitats created as a result of the beneficial use of dredged material FY95 maintenance event in the Baptiste Collette Bayou study area, shown by comparing November 1994 and November 1995. 5-50

Figure 34. New habitats created as a result of the beneficial use of dredged material FY96 maintenance event in the Baptiste Collette Bayou study area, shown by comparing November 1995 and November 1996. 5-51

LIST OF TABLES

TABLE 1 Baptiste Collette Bayou Area: 1975-1996 5-17

TABLE 2 October 1975 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area 5-26

TABLE 3 December 1985 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area 5-28

TABLE 4 December 1990 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area 5-30

TABLE 5 February 1993 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area 5-32

TABLE 6 November 1994 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area 5-34

TABLE 7 November 1995 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area 5-36

TABLE 8 November 1996 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area 5-38

TABLE 9 Cumulative Change in Total Acres of each Habitat In the Study Area Between 1975, 1985, 1990, 1993, 1994, 1995 and 1996 5-42

INTRODUCTION

The Baptiste Collette Bayou (BCB) navigation channel is located on a Mississippi River distributary northeast of Venice, Louisiana. (Figure 1). The navigation channel runs south to north and extends approximately 3.5 miles from Head of Passes into Breton Sound. The U.S. Army Corps of Engineers - New Orleans District (USACE-NOD) maintains the channel by annual dredging with a cutterhead dredge. Approximately 700,000 to 900,000 cubic yards of sediment is dredged annually and the physical character of the material is estimated to be 30 percent sand and 70 percent silt/clay. The dredged material is used in confined and unconfined beneficial use areas for wetland development.

The Beneficial Use of dredged material Monitoring Program (BUMP) at Louisiana State University - Coastal Studies Institute (LSU-CSI) is documenting the beneficial use of dredged material using aerial photography, geographical information system (GIS) analysis, and field surveys through the sponsorship of the USACE-NOD. This site was used as the Pilot Study site for BUMP in 1993 and this report includes revised and updated information from that pilot study, through and including the USACE-NOD Fiscal Year 1996 maintenance event (31 Jul 96 - 16 Sep 96). BUMP results are provided in map series, annual reports, and scientific literature.

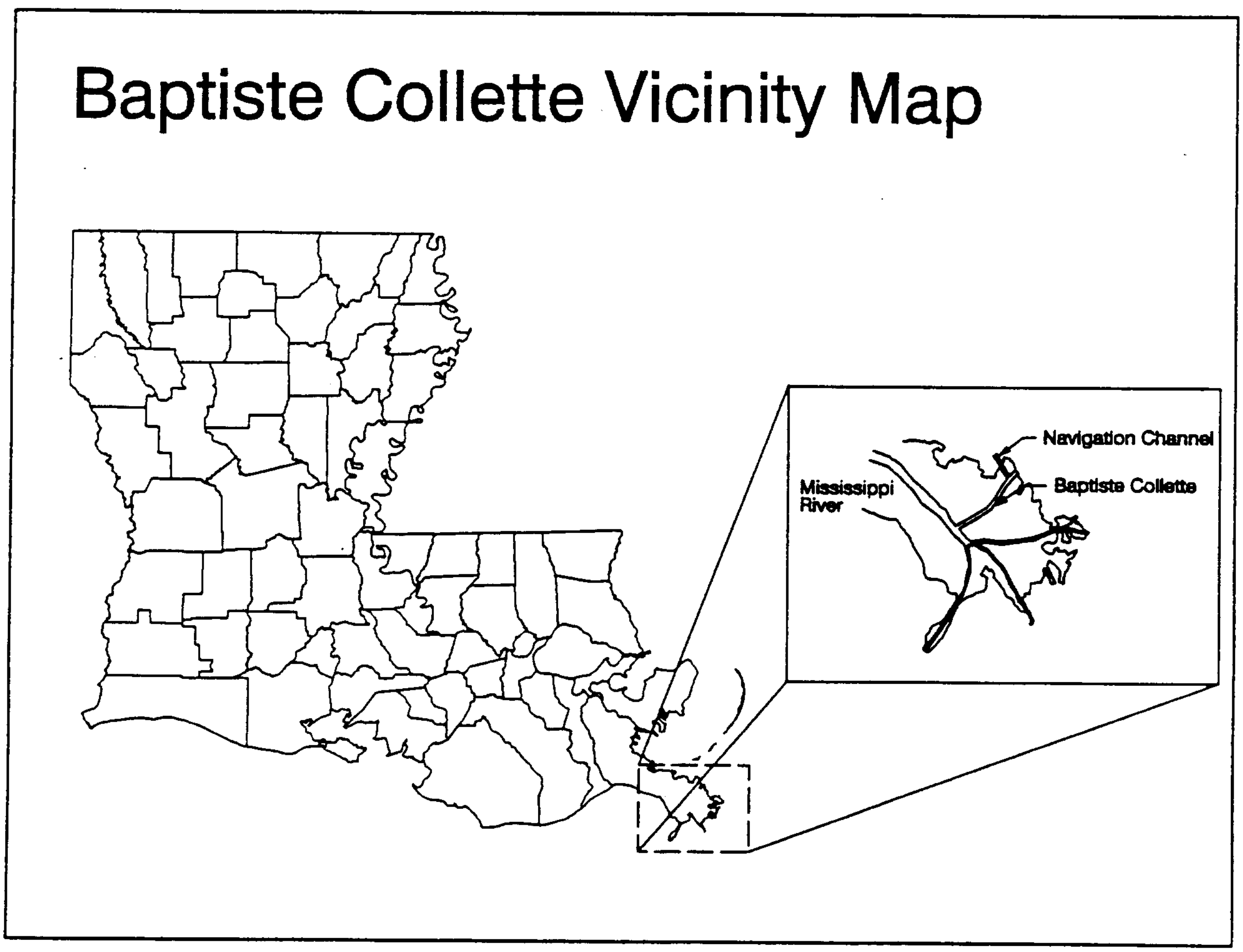


Figure 1. The location of the Baptiste Collette Bayou navigation channel in Louisiana.

This is the fifth part of the nine part Beneficial Use of dredged material Monitoring Program (BUMP), 1996 Final Report, representing monitoring results through the USACE-NOD Fiscal Year 1996. The nine parts are:

- Part 1: Introduction and Methodology
- Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
- Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
- Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
- Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
- Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass
- Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Canal, Louisiana - Bay Chaland
- Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe
- Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Using aerial photography, LSU classified the natural and man-made habitats in the study area for October 1975, December 1985, December 1990, February 1993, November 1994, November 1995 and November 1996. Through GIS analysis, the areas of sites selected were calculated and changes documented. Field surveys were conducted in August 1995 on the beneficial use areas created in 1992 and 1994, and in August 1996 on areas created in 1995 and 1996. Habitats were ground truthed and survey transects established to document vegetation species, stacking elevations, and as a base for measuring subsidence. Figure 2 shows the area of minimum aerial photo-mosaic coverage and the limit of the digitized area.

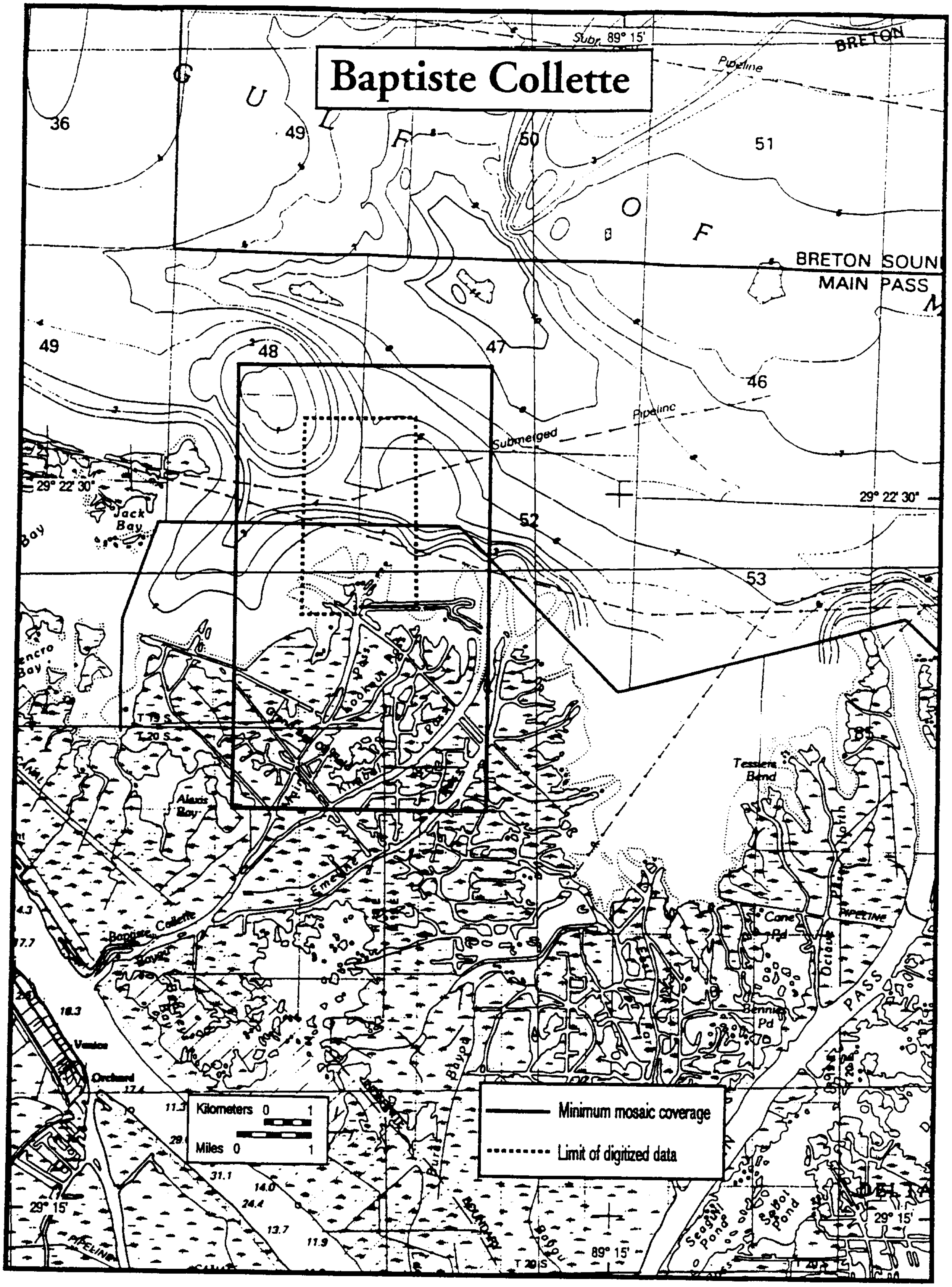


Figure 2. The Baptiste Collette Bayou BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized.

DREDGED MATERIAL DISPOSAL HISTORY

Baptiste Collette Bayou existed as a small canal in 1868 that extended between the river and what was then known as Bird Island Sound. In 1874, a crevasse occurred, and by 1893, a small subaerial subdelta had been formed. In 1908, the Corps of Engineers dammed the crevasse to maintain the flow through the navigation channels. In 1915, the dam was breached and growth of the subdelta resumed. The subdelta was nearly 20 square miles in 1959, but considerable subsidence and ponding was evident on the 1959 survey, indicating that the deterioration phase of this subdelta had already begun (Morgan, 1977).

The River and Harbors Act of 1968, approved August 13, 1968, authorized the USACE-NOD to enlarge the existing channel of Baptiste Collette Bayou to -14 feet Mean Low Gulf (MLG) over a bottom width of 150 feet with an entrance/bar channel in open water 16 feet deep over a bottom width of 250 feet. Jetties to the 6 foot depth contour also were authorized. Enlargement of the channel began in November, 1977 and was completed in May, 1978. Jetty construction was completed in May 1979.

Beneficial use of dredged material from maintenance of the Baptiste Collette bar channel began in 1977 with the placement of dredged material in shallow open water on the east side of the channel in a manner conducive to wetland creation and to the creation of islands for colonial nesting seabirds. Wetland creation on the west side of the jettied channel began in 1988. Maintenance dredging takes place annually and all dredged material is used for confined or unconfined wetland creation and the creation of islands suitable for avian habitat. Figure 3 illustrates the dredged material disposal history for the study areas since 1975.

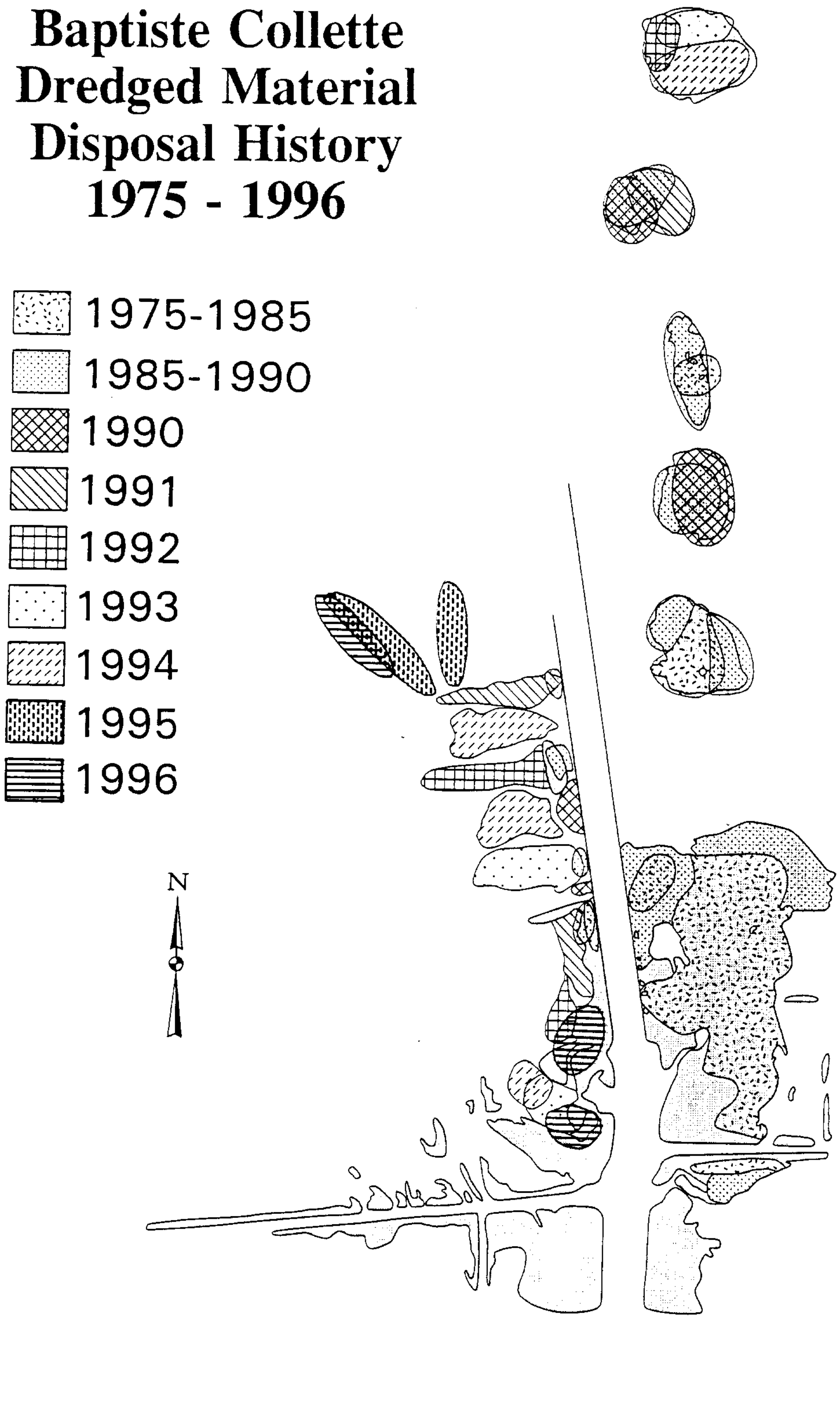


Figure 3. The dredged material disposal history for the Baptiste Collette Bayou study area, 1975 to 1996.

FIELD SURVEY RESULTS

Methodology

Elevation Profile Surveys

The BUMP study area is located where the Baptiste Collette Bayou navigation channel leaves the Mississippi River delta marshes and enters Breton Sound (Figure 1). The collection of elevation profile surveys was conducted in two phases. Phase-I involved assessing the characteristics of various beneficial use disposal areas to determine the most applicable sites to establish a long-term monitoring program to document the beneficial use of dredged materials and habitat development. This was accomplished by reviewing the BCB pilot study, using vertical aerial photography, reviewing dredging schedules and history, ground-truthing the study area, and by defining vegetative composition and island morphology. Based on these factors, three areas were selected: one *bird island* (Shea Island) on the east side of the channel and two spits (Seal and South Chris islands) on the west side of the channel (Figure 4). Transect lines were positioned on each site along both the longitudinal and lateral axes. Two stakes were placed to define the orientation of each longitudinal transect line, recording secondary features such as towers or navigation markers to assist in locating the transects when the vegetation becomes taller or thicker. Permanent 1-inch diameter by 6-foot galvanized stakes were driven approximately 3.5 feet into the ground and secured with concrete. The stakes were positioned at congruent distances and their position was defined spatially using a Global Positioning System (GPS). The dip transects were established at approximately 90° to one of the stakes. Temporary white, ten-foot PVC poles with flagging and neon orange paint were slipped over the galvanized stakes to make profile siting and re-location easier.

Phase-II involved the actual collection of profile datum. In August 1995, profile surveys were conducted along the transects defined by the stakes during phase-I. Subsequent profiles were collected in August 1996. One longitudinal *strike* (island crest) profiles and one lateral *dip* (perpendicular to island crest) transect profile was collected from each site (Figure 10). Survey datum and profiles were collected using a Topcon GTS-300$_{DPG}$ Total-Station, tri-prism, and TDS48 Data Collection System. Horizontal accuracy of the GTS-300 is 0.25 ft ± 0.0125 ft., with a vertical accuracy of 0.45 ft ± 0.0125 ft. The maximum horizontal range with tri-prism is 3,525 ft. A Pathfinder Professional MC-5 global positioning system (GPS) device was used to record the horizontal positions of each stake, instrument location, and the position and exact orientation of each transect line. The transect datum collected were processed, referenced to the benchmark at the Southern Natural Gas platform and the permanent tide staff in the channel, and entered into a graphic software program to produce topographic profiles.

The topographic profiles for the study area were constructed in reference to the U. S. Army Corps of Engineers benchmark #SNG, at the Southern Natural Gas platform located on the east side of the channel (Figure 4). The mean diurnal tidal range for the Baptiste Collette Bayou area is published as 1.1 ft. Profiles ranged in length from 1185 to 1300 feet. Maximum relief along the profiles was 6.55 feet at Shea Island.

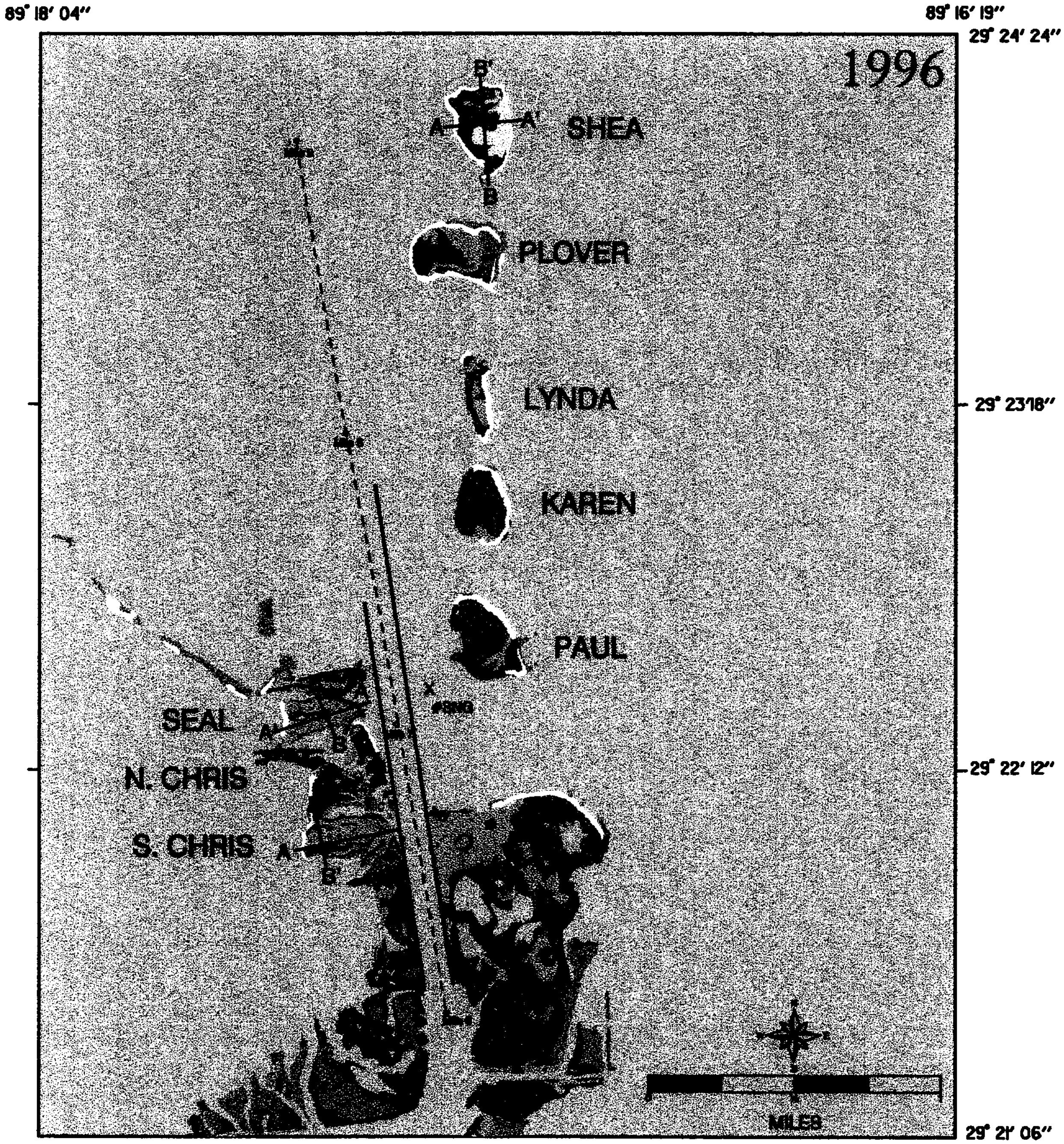


Figure 4. Location of the Baptiste Collette Bayou BUMP study area profile transects and the benchmark (#SNG) that was used to reference the elevation data.

Vegetation Surveys

Initial ground truthing for vegetative species composition and habitat verification was done in August 1995, and the species list has been augmented by subsequent field visits. Species composition was determined within a six-foot swath along each profile, and major divisions between vegetative communities were entered as points on the elevation profile. No submerged aquatic species were considered for this report. Plants were identified in the field with only representative specimens taken for confirmation by taxonomic keys and/or verification by the LSU Department of Plant Biology. The better specimens and uncommon specimens were entered into the LSU herbarium collection; all others were archived by the author. The percent composition of each species was visually estimated in order to determine the relative abundance and dominance of species for habitat determinations. These percentages were not intended to provide scientific ratios or statistics. The species list included in the Appendix 5A of this report is not complete; it reflects only those species that were readily observed during the profiling period. Some plants can only be identified during a short flowering period which may not have coincided with the ground truthing or the profile data collection, and therefore can not be included in the list other than by a broad classification.

Profiles

For the pilot study completed in 1993, elevation and vegetation data were obtained, but profiles were not permanently established. Therefore, we could not reoccupy them for comparison purposes with any degree of scientific accuracy. The 1995 profiles were established with metal poles (stakes) set in concrete and extending 2-3 feet from the sediment surface. Two stakes were placed at each site to define a permanent *strike* profile. A *dip* profile was taken near-perpendicular to the *strike* from one of the stakes. The 10-foot, white PVC poles were still in place at the time of the 1996 field effort, making re-location much less difficult.

Shea Island

Shea Island is the most seaward *bird island* located along the northeast side of Baptiste Collette Bayou near the mouth of the outlet to Breton Sound (Figure 4). The construction of Shea Island was initiated during the USACE-NOD FY1993 maintenance event. The island was enlarged during the FY1994 maintenance event. No disposal took place on this island in FY1995 or FY1996.

The *strike* transect was delineated by 2 stakes (1-0 and 1-1) set east northeast (85°) along the axis of newest deposit, and the *dip* transect was positioned to cross both the new deposit and old island at the western-most stake (1-0). The visual line is between a red navigation marker to the west and a large platform to the east. The disposal material was a silty fine sand and was constantly reworked into small aeolian dunes around areas of sparse vegetation. Vegetation had not increased significantly since the 1995 field effort.

Figure 5 shows the comparison between the August 1995 and August 1996 elevation profiles. This comparison shows that the margins of Shea Island eroded over 100 feet on each side and that the surface elevation decreased as much as one foot.

The 1996 profiles here ranged in length from 1185 to 1300 ft . The maximum relief along the longitudinal axis (A-A') is 6.55 ft, with an average relief of 4.56 ft. Maximum relief along the lateral axis (C-C') is 5.62 ft, with an average relief of 3.94 ft. Profile A-A' is defined by stakes 1-0 and 1-1, and by stake 1-1 for profile C-C' (Figure 6).

In contrast, the 1995 profiles here ranged in length from 1460 to 1650 ft. The maximum relief along the longitudinal axis (A-A') was 7.70 ft, with an average relief of 4.64 ft. Maximum relief along the lateral axis (B-B') was 4.68 ft, with an average relief of 3.40 ft. The elevation at the top of these stakes was 6.83 ft at stake 1-0, and 8.32 ft at stake 1-1 (Figure 7).

These profiles indicate that the island is typically characterized as a sand flat with patches of young amorphous dunes which produce an undulating topography. Random patterns of dune formation and scattered pockets of developed vegetated clumps amid the overall low, flat profile of this area suggests vegetative colonization and dune building will produce a dune terrace.

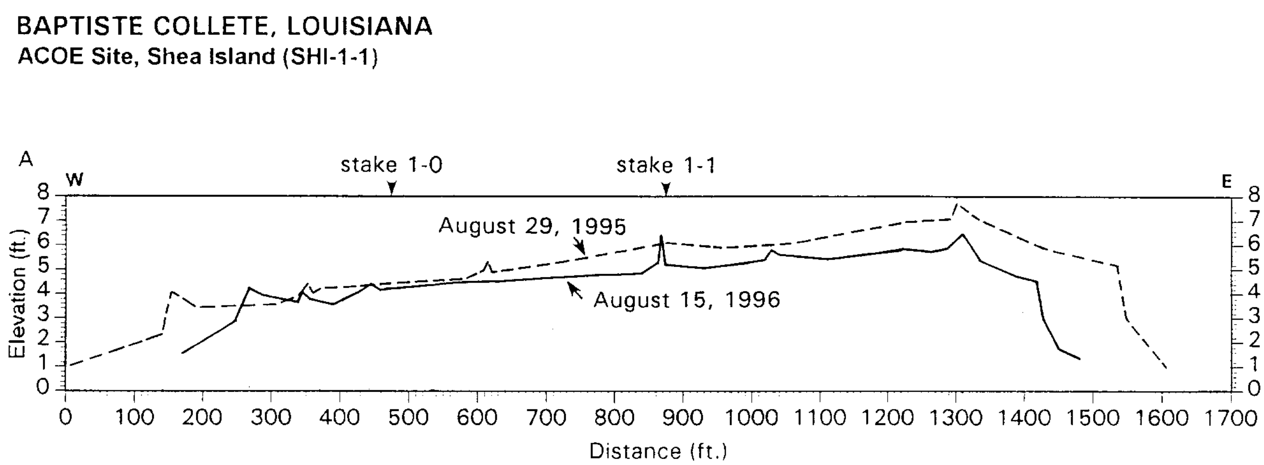


Figure 5. The *Strike* profile SHI-1-1 at Shea Island comparing elevation data obtained on August 30, 1995 and August 15, 1996.

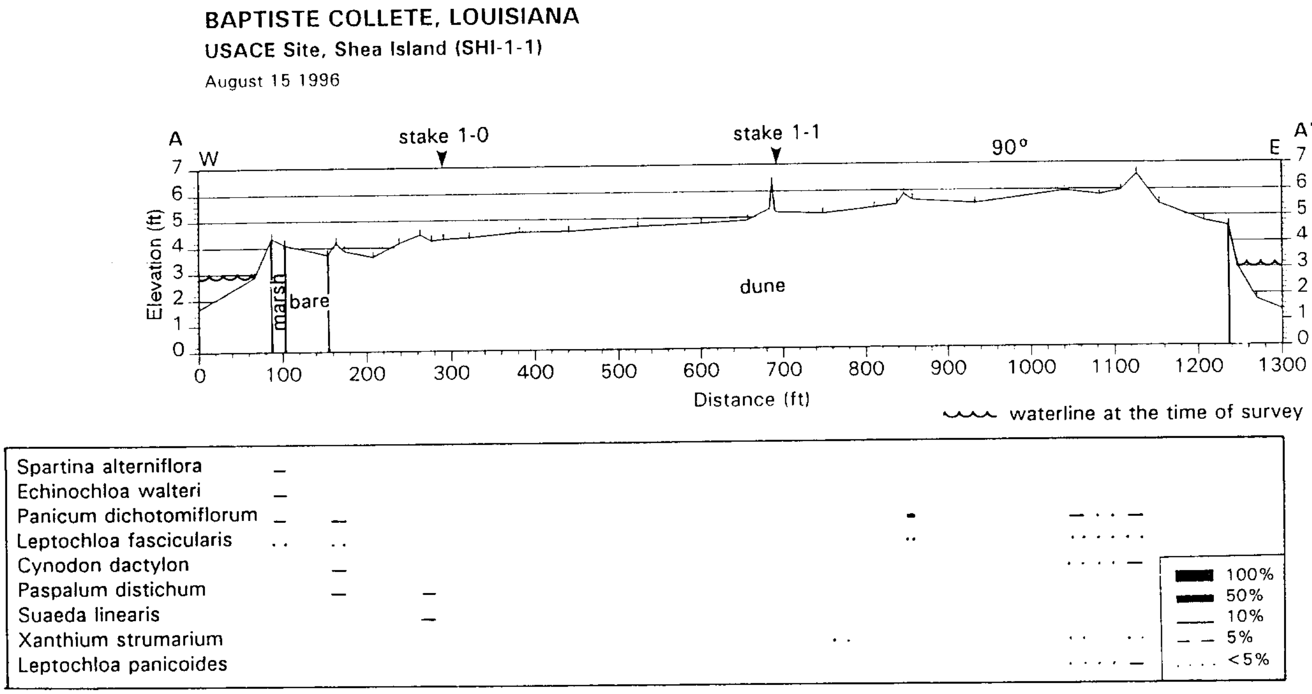


Figure 6. August 1996 *Strike* profile SHI-1-1 at Shea Island with vegetation data illustrated.

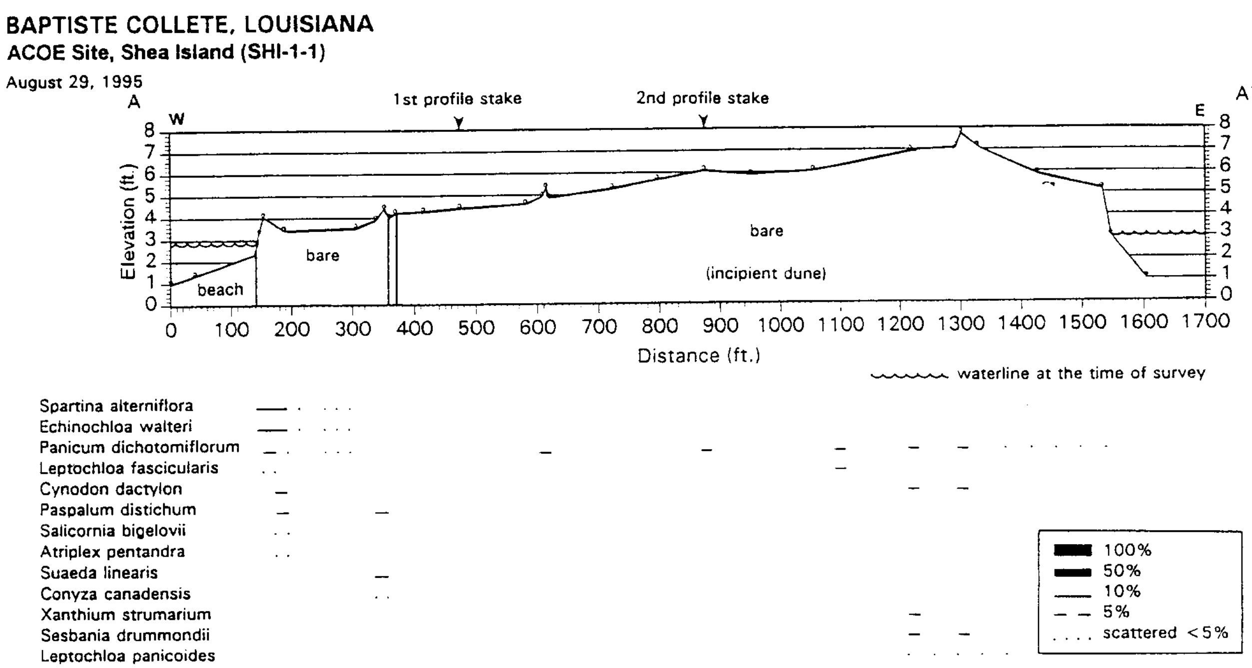


Figure 7. August 1995 *Strike* profile SHI-1-1 at Shea Island with vegetation data illustrated.

South Chris Island

South Chris Island is located along the northwest side of Baptiste Collette Bayou near the mouth of the outlet to Breton Sound (Figure 4). South Chris Island was constructed during the 1993 maintenance event. In 1995, an effort was made to establish the profile as close as possible to the profile taken during the 1993 BUMP Pilot Study. The *strike* profile (A-A') was defined by 2 stakes (1-0 and 1-1) just to the south of the axis of island, in line with navigation marker *14* at the jetty, and the *dip* profile(B-B') was near-perpendicular to the strike at the west stake (1-0). The *strike* profile was set just south of the island crest because a line of tall shrubs occupied the highest ridge, making it difficult to survey. In 1996, the transect was repeated.

Figure 8 shows the comparison between the August 1995 and August 1996 elevation profiles. This comparison shows that the margins of Chris Island eroded up to 40 feet and the elevation along the eastern margin decreased up to one foot.

In 1995, the profiles here ranged in length from 500 to 1800 ft. The maximum relief along the longitudinal axis (A-A') was 3.74 ft, with an average relief of 2.74 ft. Maximum relief along the lateral axis (B-B') was 3.45 ft, with an average relief of 2.58 ft (Figure 9).

In 1996, the profiles here ranged in length from 550 to 1825 ft (Figure 10). The maximum relief along the longitudinal axis (A-A') was 3.55 ft, with an average relief of 2.76 ft. Maximum relief along the lateral axis (B-B') was 3.59 ft, with an average relief of 2.31ft. The profiles indicate that the island is typically characterized as a low relief sand flat with a longitudinal sand crest and well-developed vegetation along the perimeter of the island. The crest of the island exhibits patches of young amorphous dunes producing an undulating dune terrace morphology (Figure 10).

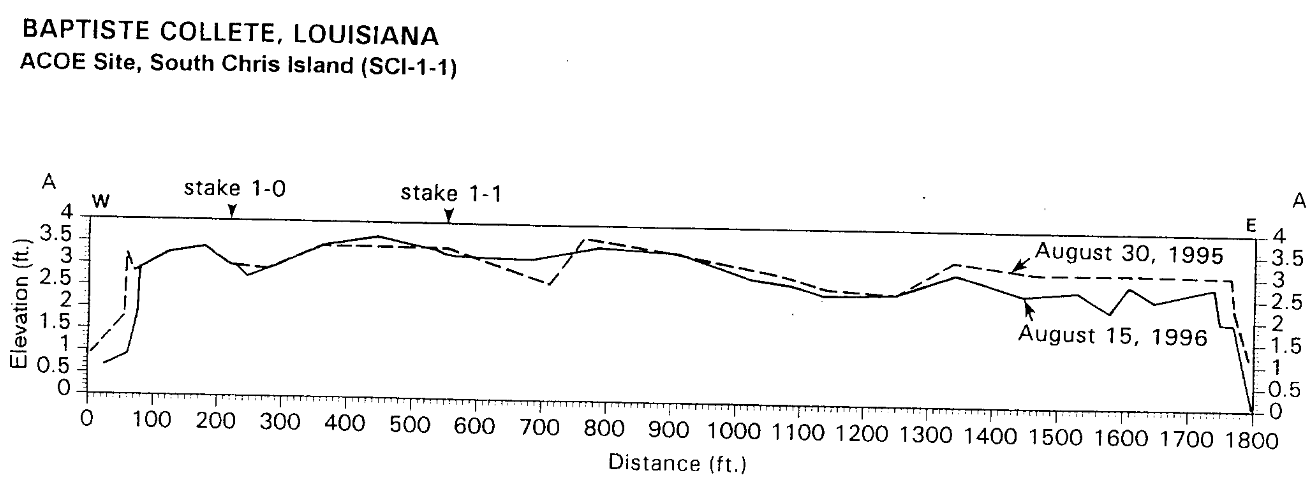


Figure 8. A comparison of the elevation data along the *strike* profile SCI-1-1 at South Chris Island obtained on August 30, 1995 and August 15, 1996.

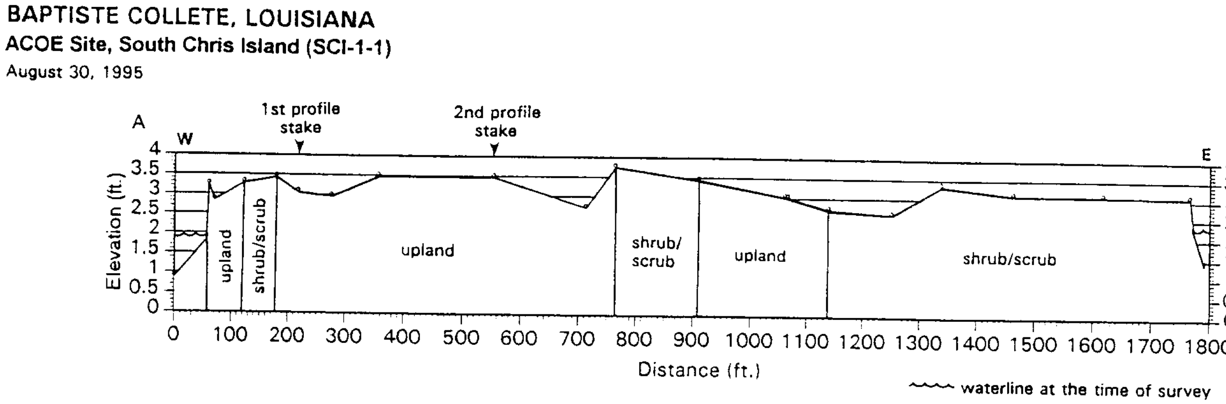


Figure 9. *1995 Strike* profile SCI-1-1 at South Chris Island with habitat data illustrated.

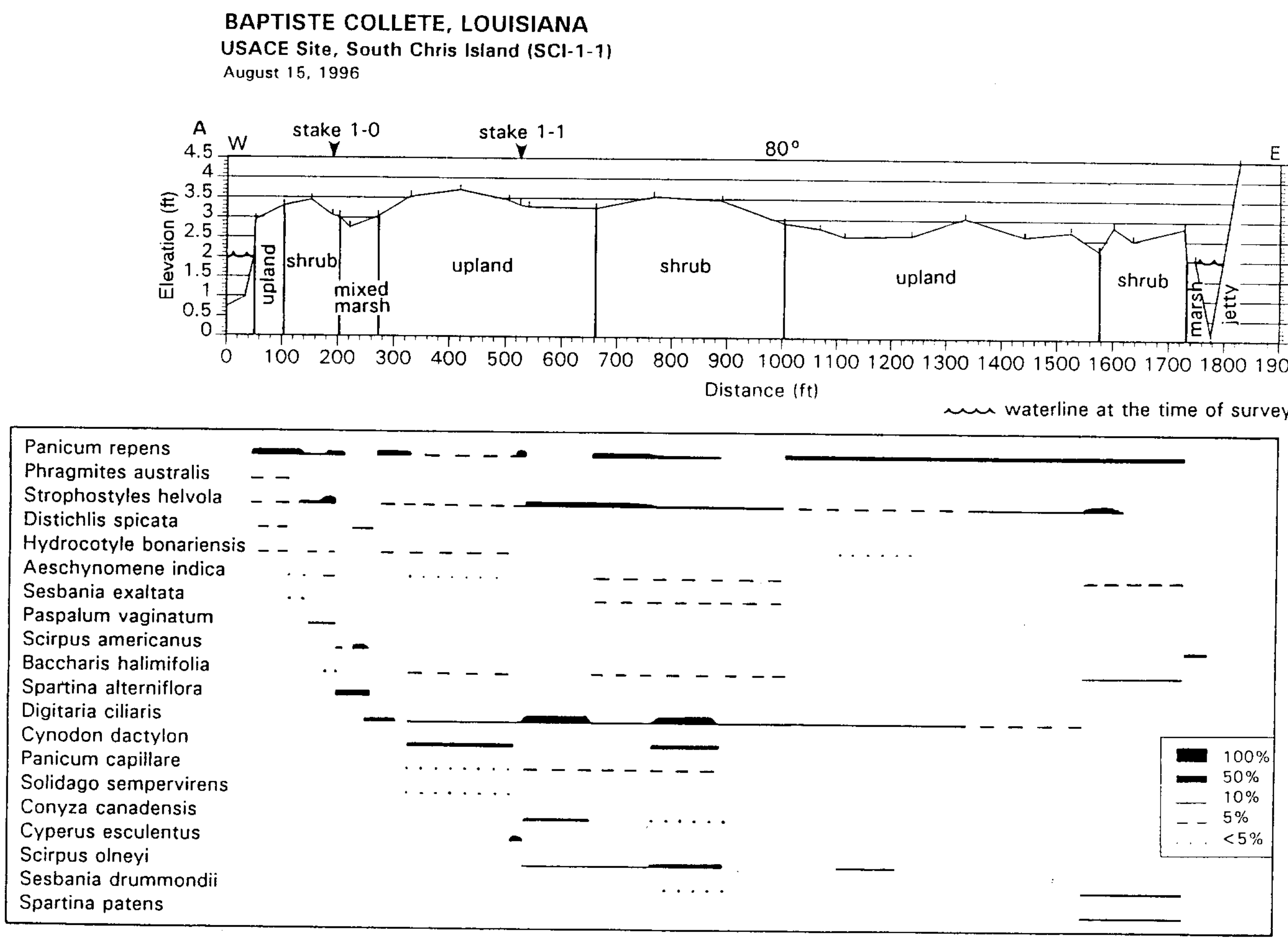


Figure 10. 1996 *Strike* profile SCI-1-1 at South Chris Island with vegetation data illustrated.

Seal Island

Seal Island is located along the northwest side of Baptiste Collette Bayou near the mouth of the outlet to Breton Sound just north of South Chris Island (Figure 4). Seal Island was constructed during the 1994 maintenance event. The *strike* profile (A-A') was defined by 2 stakes (1-0 and 1-1) set east northeast along the axis of the south lobe of this new island, and the *dip* profile (B-B') is across the entire island from the east stake (1-0). The west stake can be found 267° in line with a set of tanks to the west. The east stake is in line with the west stake and north leg of Southern Natural Gas platform across the jetty. The new deposited dredged material is fine sand and was being well-colonized by vegetation.

Figure 11 shows a comparison between the 1995 and 1996 elevation profile data. This comparison shows a similar pattern observed for Shea Island and Chris Island at Seal Island. The margins of the island eroded up to 100 feet and the elevation decreased up to one foot.

In 1995, the profiles here ranged in length from 540 to 1795 ft. The maximum relief along the longitudinal axis (A-A') is 4.35 ft, with an average relief of 3.07 ft. Maximum relief along the lateral axis (B-B') was 3.34 ft, with an average relief of 2.58 ft (Figure 12).

In 1996, the profiles here ranged in length from 430 to 1865 ft. The maximum relief along the longitudinal axis (A-A') is 4.38 ft, with an average relief of 2.94 ft. Maximum relief along the lateral axis (B-B') was 3.19 ft, with an average relief of 2.67 ft. The profiles indicate that the island is typically characterized as a sand flat with patches of young amorphous dunes producing an undulating dune and sparse vine terrace morphology. Patterns of dune formation and sparse pockets of developed vegetated clumps throughout the flat profile of this area indicates revegetation and dune building is occurring (Figure 13).

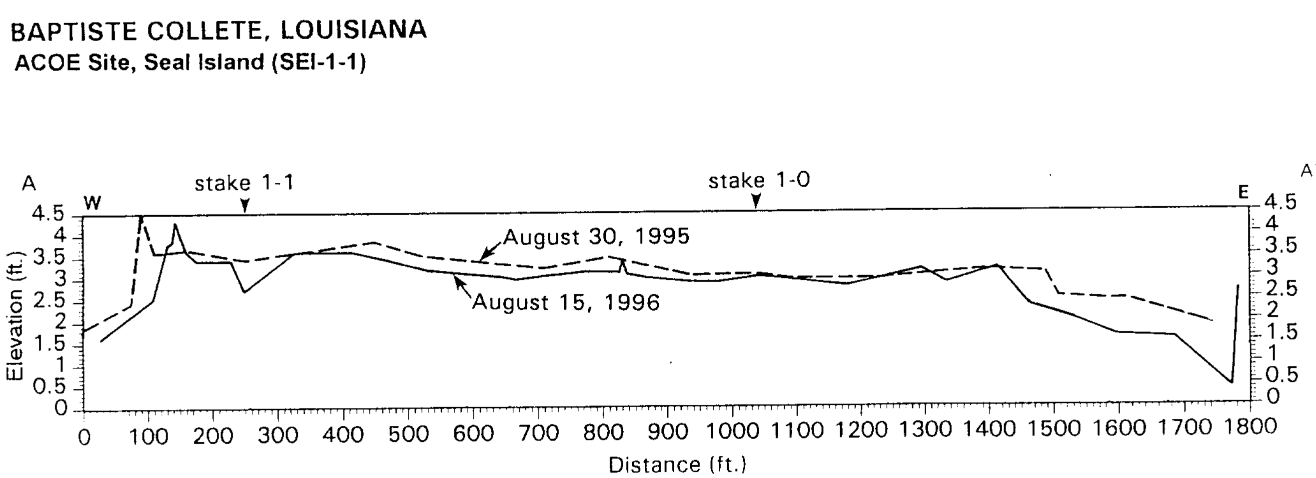


Figure 11. The *Strike* profile SEI-1-1 at Seal Island comparing elevation data obtained on August 30, 1955 and August 15, 1996.

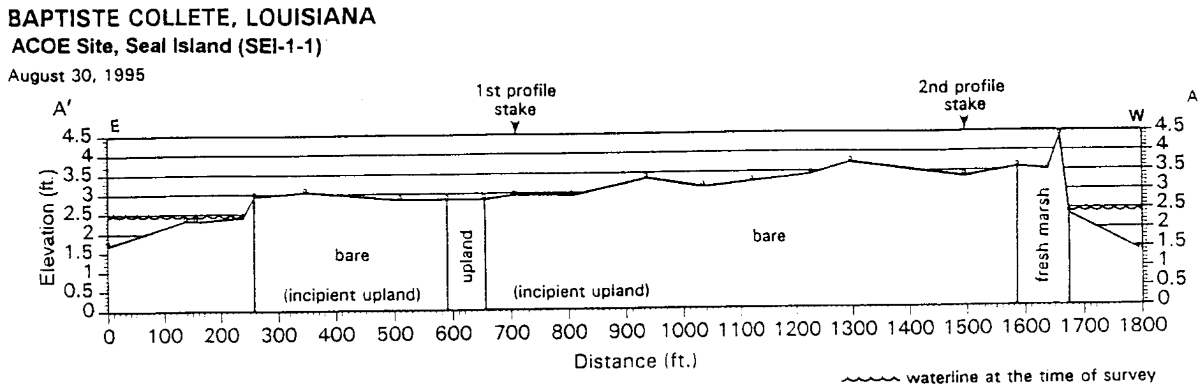


Figure 12. 1995 *Strike* profile SEI-1-1 at Seal Island with habitat data illustrated. This profile was plotted in reverse in relation to the 1996 data.

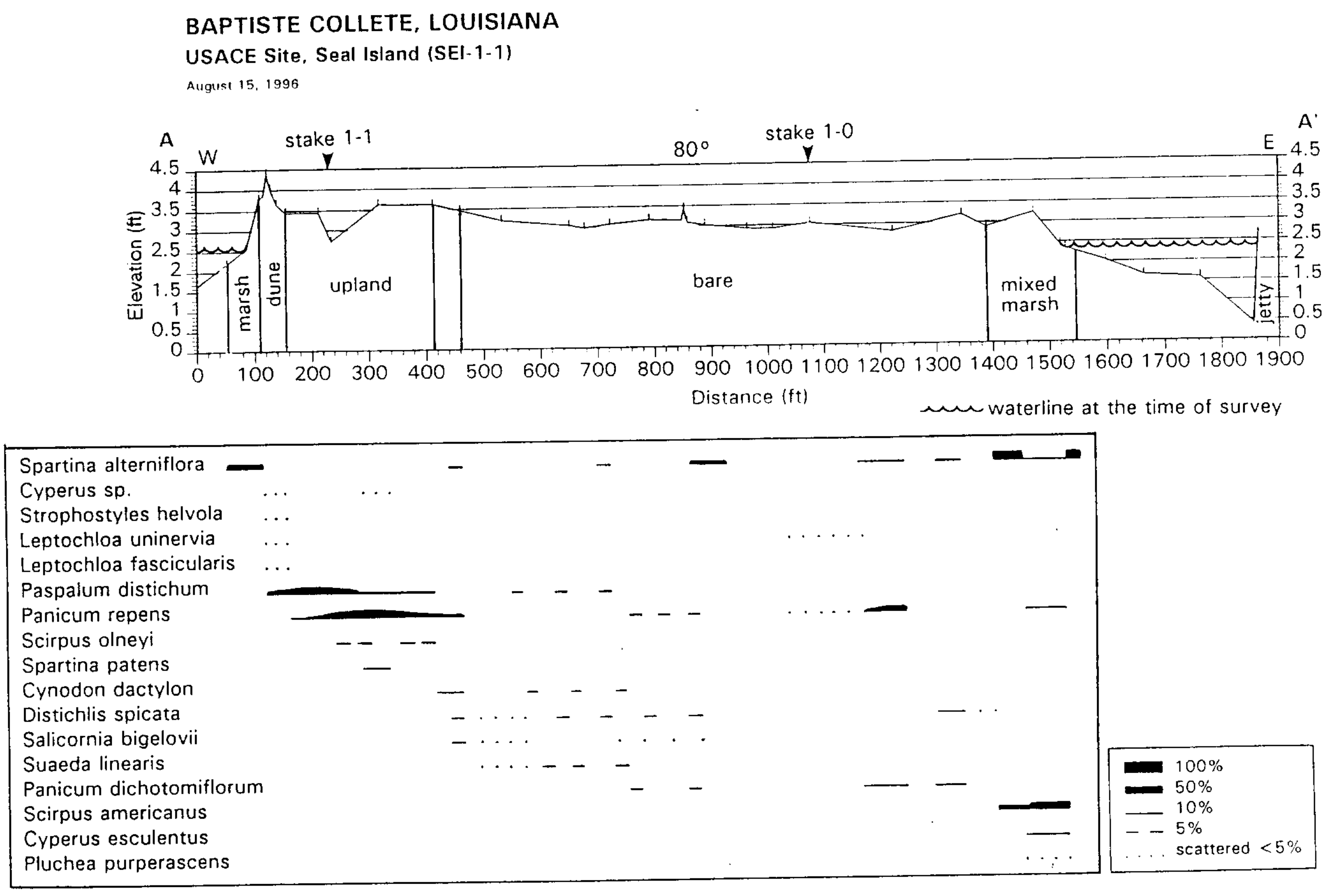


Figure 13. 1996 *Strike* profile SEI-1-1 at Seal Island with vegetation data illustrated.

Vegetative Character

General Description

The overall marsh type for this area is classified as intermediate marsh. The marsh exposed to the daily tides (low marsh) exhibited a mixed marsh community in response to the frequently changing salinity regime that exists at the mouth of a Mississippi River distributary. During the time of the field survey, Oyster grass (*Spartina alterniflora*), a typical salt marsh species, was growing next to or mixed with fresh marsh species of duck potato (*Sagittaria latifolia*) and softstem bulrush (*Scirpus validus*), with water hyacinth (*Eichhornia crassipes*) thickly rafted against these. The salinity regime of this area changes periodically due to changes in freshwater flow from the Mississippi River, which at times favors salt marsh development at low-flow/high salt levels, or fresh marsh development at high-flow/low salinity levels. Salt marsh species, in general, establish quickly in saline conditions and grow well under freshwater conditions, but they can be out-competed by other non-saline tolerant species. Most freshwater species that establish during fresh conditions cannot tolerate saline water for long and die. Intermediate marsh species tolerate a little of both and are therefore the most prevalent.

The navigation channel is dredged frequently and new areas are created annually. The islands on the east side of the channel are maintained at a higher elevation than those to the west to provide habitat for the many bird species that nest and roost in the area. The islands to the west of the jetties were created at a lower elevation to encourage marsh development.

Vegetative community types

The low marsh in the study area is inundated by daily tides and consist of a mixture of *Spartina alterniflora* (salt marsh), *Scirpus americanus* (fresh to intermediate marsh) and *Echinochloa walteri* (also fresh to intermediate marsh) in solid or intermixed stands. The outer edges of the marsh also included *Scirpus validus*, *Polygonum lapathifolium*, *Eichhornia crassipes*, *Leptochloa panicoides*, *Cyperus odorata*, *Sagittaria latifolia*, and *Panicum repens*. Various *Cyperus* species, and *Leptochloa fascicularis* occurred along the margins between low and high marsh areas.

High marsh areas in the study area are inundated periodically by high tides and were heavily represented by grasses and intermediate marsh species, mainly *Spartina patens*, *Echinochloa walteri*, and *Distichlis spicata*, with scattered *Phragmites australis*, *Pluchea odorata*, *Ammania coccinea*, *Xanthium strumarium*, *Heliotropium curassavicum*, *Aster subulatus*, and *Aster tenufoilus*. There were small stands of *Phragmites* surrounded by *Paspalum vaginatum*, and some *Panicum repens* and *Salicornia bigelovii*. Low wet areas within the high marsh, included *Distichlis spicata*, *Panicum repens*, *Bacopa monnieri*, *Alternanthera philoxeroides*, *Leptochloa panicoides*, *Panicum dichotomiflorum*, *Polygonum lapathifolium*, and *Ammania coccinea* and showy species such as *Ludwigia decurrens*, *Ludwigia octovalvis*, *Bidens frondosa*, *Aster tenuifolius*, and *Aster subulatus*. There were extensive flats of *Salicornia bigelovii* and *Distichlis spicata* which sometimes included *Paspalum distichum*, *Panicum repens*, *Sesuvium portulacastrum*, *Cyperus* spp., or *Heliotropium curassavicum*.

The beach above the high waterline was colonized in bands paralleling the waterline predominantly by *Echinochloa walteri, Polygonum lapathifolium, Paspalum distichum, Cyperus* spp., and *Spartina patens*. *Echinochloa, Polygonum, Cyperus, Spartina alterniflora*, and *Leptochloa fascicularis* occur at the interface of the beach with interior marsh or lagoons. *Cynodon dactylon, Aeschynomene indica, Vigna luteola, Strophostyles helvola, Leptochloa fascicularis*, and *Panicum dichotomiflorum* occur at the interface of the upper beach with upland areas.

Upland areas were represented by grasslands or terraces, including areas supporting small scattered shrubs. Grasses establish quickly on well-drained, freshly deposited dredged materials and form grasslands that help to quickly stabilize the new material. *Distichlis spicata, Panicum repens, Digitaria ciliaris, Leptochloa fascicularis, Spartina patens*, and *Panicum vaginatum* tend to be the most common grass species, with *Cyperus* sp., *Conyza canadensis, Pluchea odorata* as common herbaceous plants. The vines *Vigna luteola* and *Strophostyles helvola* were present in some high marsh areas and most upland areas entwining everything in reach into a tangled mat. Older terraces develop with additional species of *Panicum dichotomiflorum, Cynodon Dactylon*, and small stands of *Phragmites australis* or small *Sesbania drummondii* shrubs.

Shrub/scrub communities consist of woody plants to small trees under 20 feet tall. Some areas that would otherwise be classed as high marsh but support shrubs or small trees such as *Iva frutescens, Baccharis halimifolia*, or *Salix nigra* are classified as shrub/scrub. Older elevated areas develop shrub communities of *Baccharis halimifolia, Iva frutescens*, or *Sesbania drummondii* with an understory of grasses *Spartina patens, Distichlis spicata, Panicum repens, Paspalum vaginatum*, and *Echinochloa walteri*, with *Pluchea odorata*, and *Hydrocotyle bonariensis*. Advanced shrub communities also may contain an occasional *Salix nigra* and *Hibiscus moscheutos*.

Elevation and the Distribution of Vegetative Community Types

Each plant species has a habitat preference, and when taken as a community, the type of vegetation present is an indication of habitat type. Major changes in plant community composition delineate boundaries between habitats. Older deposits with more time for plants to establish, generally exhibit greater density and diversity than younger deposits. Also, with more settling of the sediment having taken place and more time for competition to effect vegetative species, older deposits exhibit a greater degree of zonation and distinct habitat formation.

The maximum elevation along the transects of the dredged material at Baptiste Collette Bayou navigation channel was 6.55 feet, on the *bird island* named Shea Island (Figure 9). The maximum elevation along the transects of the western islands was 4.38 feet on Seal Island (Figure 13).

The intermediate marsh was documented along the transects generally below 3.0 feet MSL. Upland habitat dominated by grasses and shrub/scrub habitats occurred above 3.0 feet .

GIS ANALYSIS RESULTS

Shoreline Changes: 1976-1994

Figure 14 graphs the spatial history of the Baptiste Collette Bayou (BCB) study area between 1975 and 1996 depicted in Table 1 and illustrated in Figure 15. In October 1975, the BCB study area was measured at 125.71 acres. The study area in November 1996 was measured at 588.85 acres. This is a cumulative area increase of +463.14 acres or an increase in area of +368.42 percent for the 21 year period at an overall rate of change of +22.05 acres per year. There was an overall loss of -51.83 acres of natural habitats, offset by the creation of +514.94 acres due to the beneficial use of dredged materials. Without the contribution of new habitats due to the placement of dredged material, the total coastal land loss in the study area would have exceeded -18 acres at a rate of -1.0 acres per year, which is equivalent to a one percent loss of the area per year.

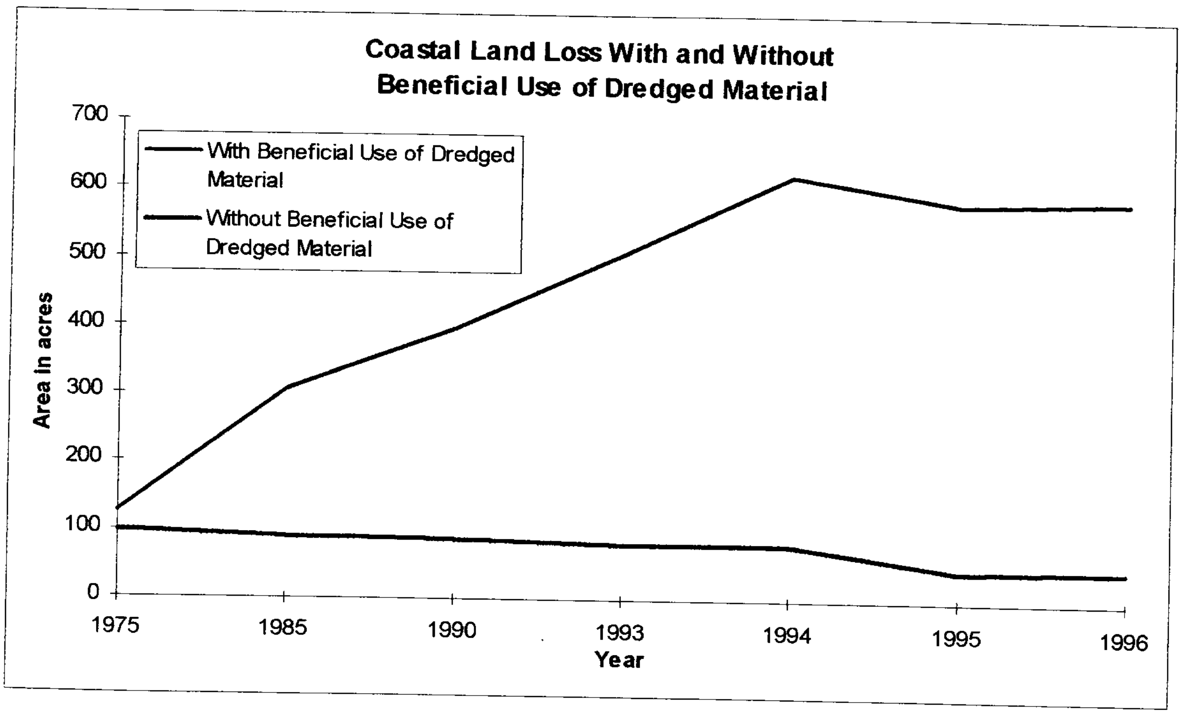


Figure 14. Graph of the area of the Baptiste Collette Bayou BUMP study area over time showing the contribution of beneficial use of dredged material. The red line graphs the total natural area excluding areas created by beneficial use of dredged materials.

TABLE 1
Baptiste Collette Bayou Area: 1975-1996

Area in Acres	Oct 1975	Dec 1985	Dec 1990	Feb 1993	Nov 1994	Nov 1995	Nov 1996
Natural Areas	99.37	89.08	88.29	82.41	81.14	44.42	47.57
BUMP-made Areas	26.34	216.72	307.76	426.24	542.04	537.21	541.29
Total	125.71	305.80	396.05	508.65	623.18	581.63	588.86

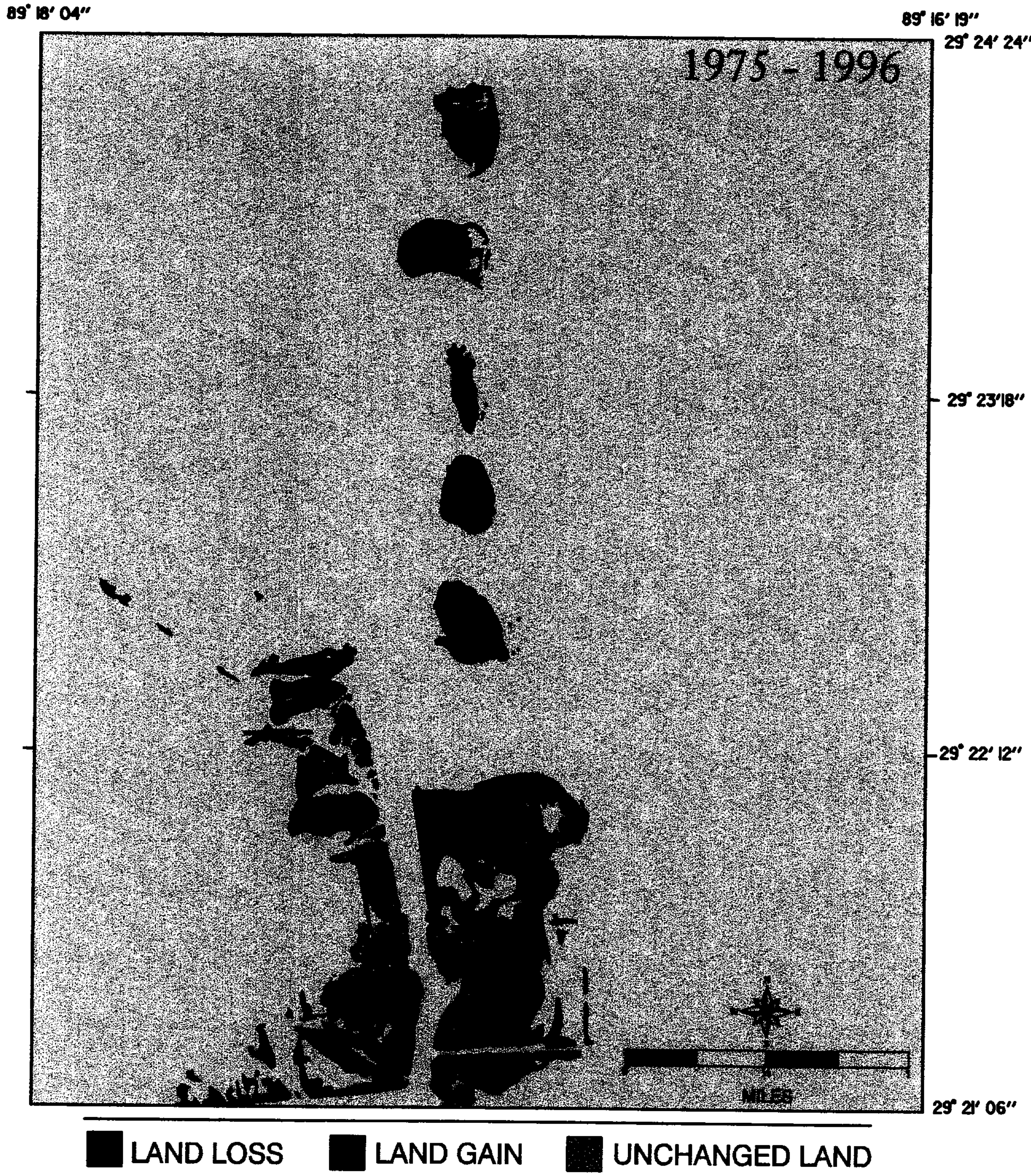


Figure 15. Shoreline change history for the Baptiste Collette Bayou BUMP study area between October 1975 and November 1996.

Figure 16 depicts the coastal land loss history for BCB between October 1975 and December 1985. The total area of BCB increased by +180.09 acres at a rate of +20.0 acres per year for this nine year period. The primary areas of progradation took place along the eastern margin of the BCB navigation channel. Land loss was associated with BCB channel widening and erosion along the western margin of the navigation channel.

Figure 17 depicts the coastal land loss history for the BCB area between December 1985 and December 1990. The area of BCB study area for this five year time period increased by +90.75 acres at a rate of +18.05 acres per year. Land gain occurred primarily along the eastern margin of the navigation channel. Land loss was concentrated on the *bird islands* and occurred sporadically in the southern portion of the study area as edge erosion.

Figure 18 depicts the coastal land loss history for the BCB study between December 1990 and February 1993. The BCB study area increased by +112.60 acres over 2.17 years at a rate of +51.89 acres per year. Land gain occurred primarily in the *bird islands* and the western side of the navigation area. Land loss took the form of edge erosion on the bird islands and along the channel margins.

Figure 19 depicts the coastal land loss history for BCB study area between February 1993 and November 1994. The BCB study area increased by +114.53 acres for the 1.75 year time period at a rate of +65.45 acres per year. The primary areas of land gain occurred in the *bird islands* and west of the navigation channel. Land loss was concentrated along the north/northeast facing shorelines of the *bird islands* and the area east of the channel.

Figure 20 depicts the coastal land loss history for BCB study area between November 1994 and November 1995. The BCB study area decreased by -50.56 acres for the 1.0 year time period. Land loss was concentrated along the north/northeast facing shorelines of the *bird islands* and the areas to the east and west of the channel at mile marker #6.

Figure 21 depicts the coastal land loss history for BCB study area between November 1995 and November 1996. The BCB study area increased by +7.23 acres for the 1.0 year time period. The primary areas of land gain occurred in the bird islands and the areas west of the channel. Land loss was concentrated along the north/northeast facing shorelines of the *bird islands* and the area east of the channel.

In addition to the creation of new habitats, the effect of the beneficial use of dredged materials has been to accelerate the progradation of the BCB distributary channel. The sediments that accumulate in the BCB navigation channel are primarily distributary mouth bar sands and silts. Prior to the beneficial use of dredged materials at the BCB navigation channel, this distributary was prograding at a rate of ±100 meters per year. Since 1985, the rate of distributary progradation at the BCB has accelerated to rates greater than +400 meters per year on the east side of the channel and to rates greater than +200 meters per year on the west side of the channel.

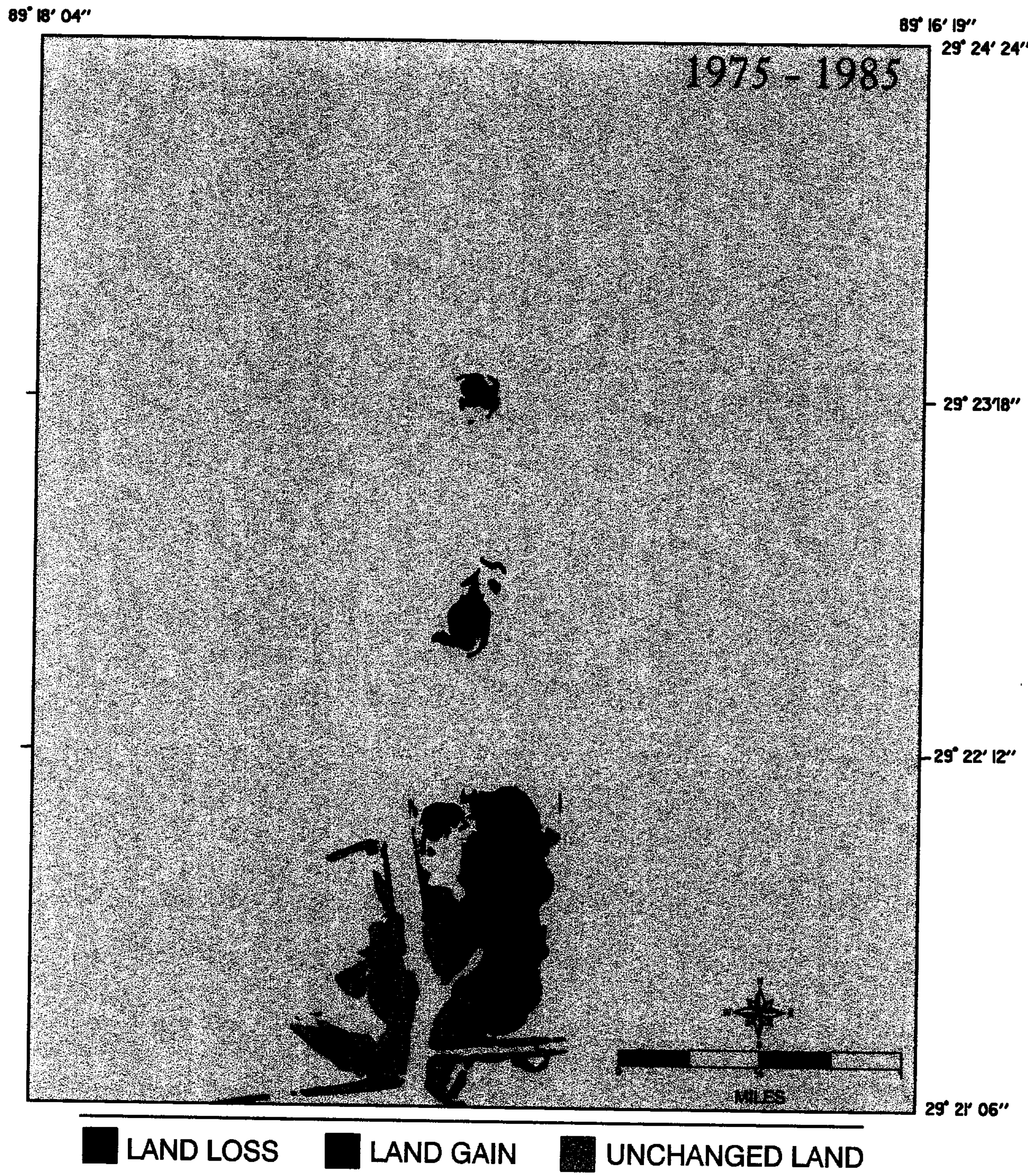


Figure 16. Shoreline change history for the Baptiste Collette Bayou BUMP study area between October 1975 and December 1985.

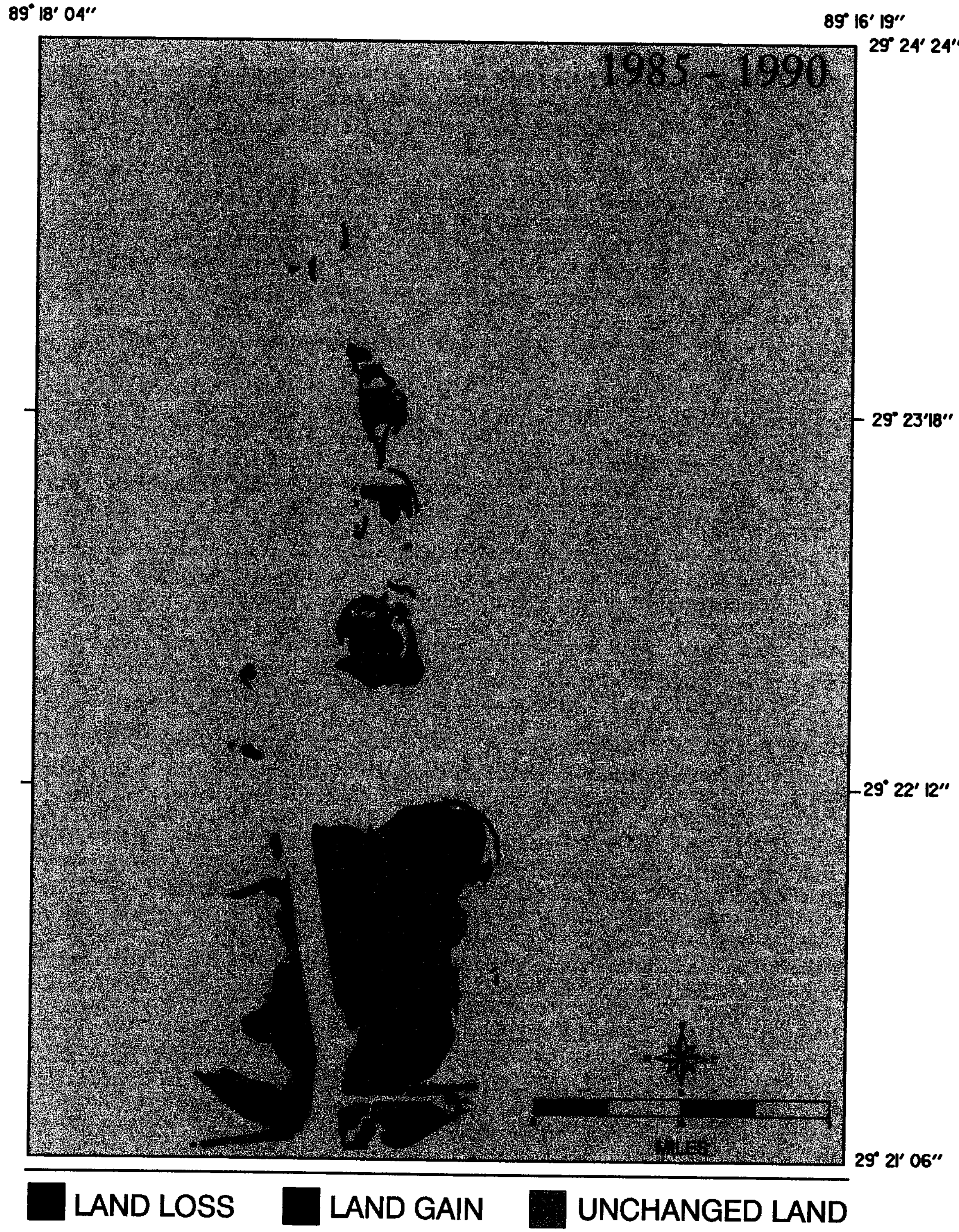


Figure 17. Shoreline change history for the Baptiste Collette Bayou BUMP study area between December 1985 and December 1990.

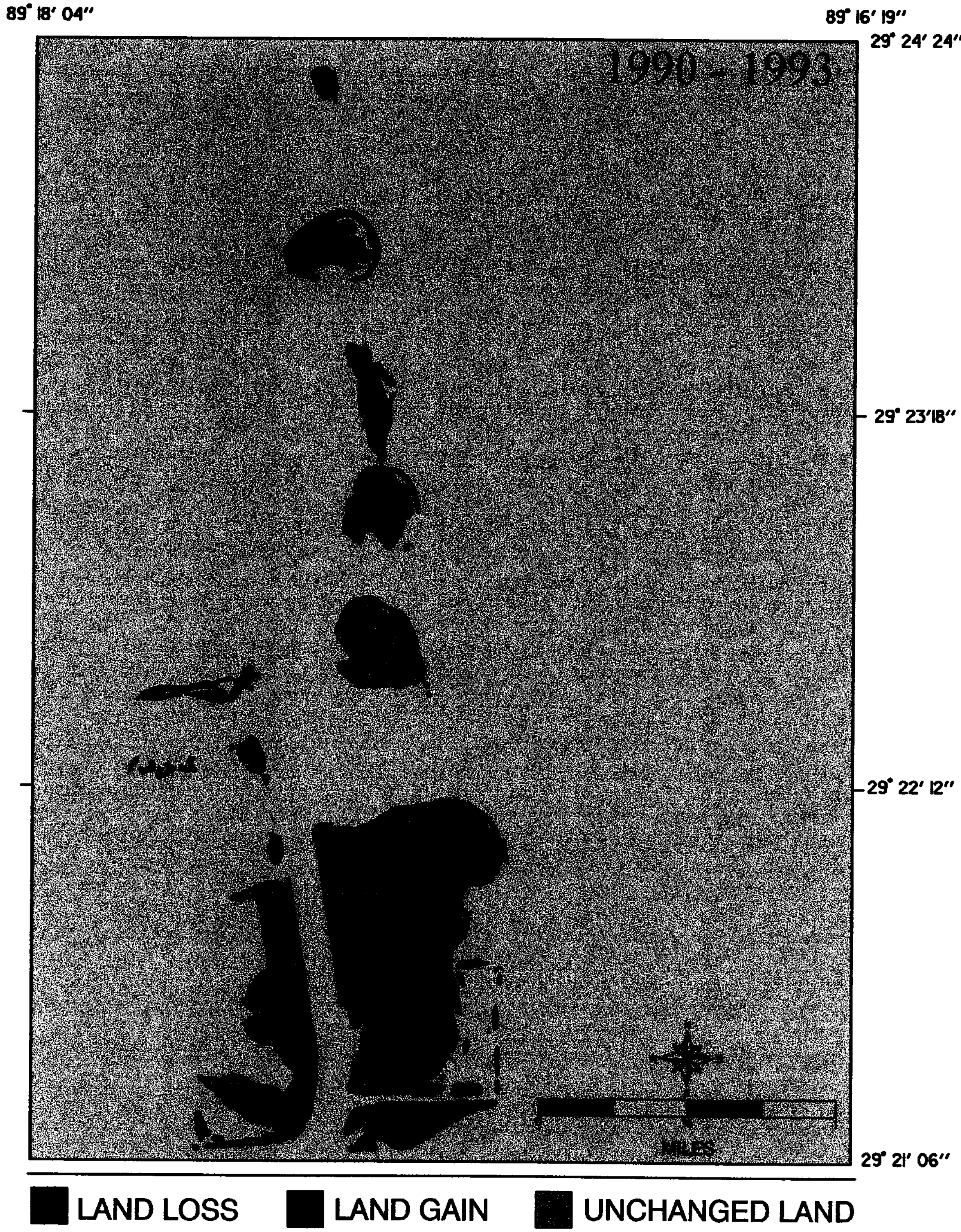


Figure 18. Shoreline change history for the Baptiste Collette Bayou BUMP study area between December 1990 and February 1993.

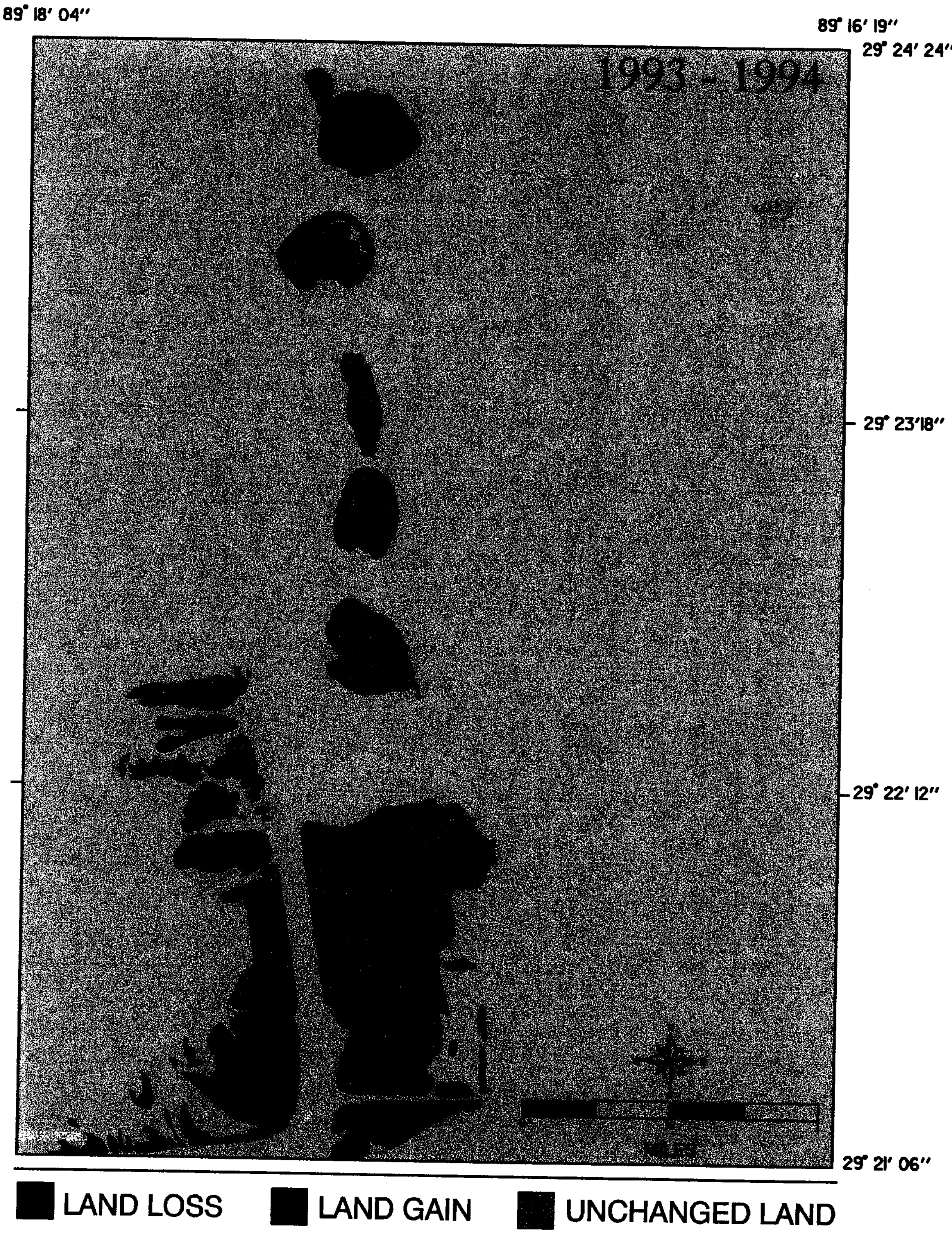


Figure 19. Shoreline change history for the Baptiste Collette Bayou BUMP study area between February 1993 and November 1994.

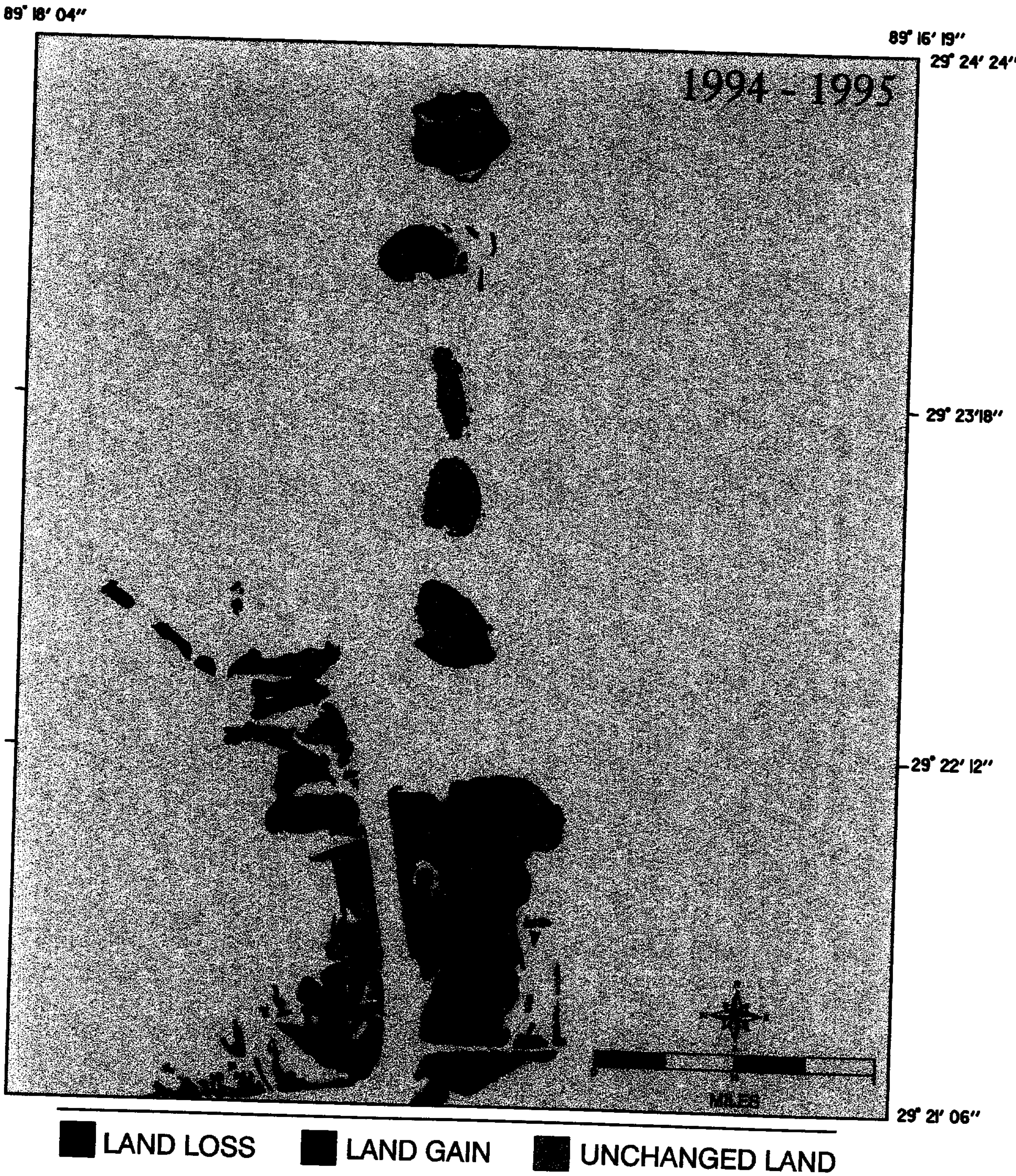


Figure 20. Shoreline change history for the Baptiste Collette Bayou BUMP study area between November 1994 and November 1995.

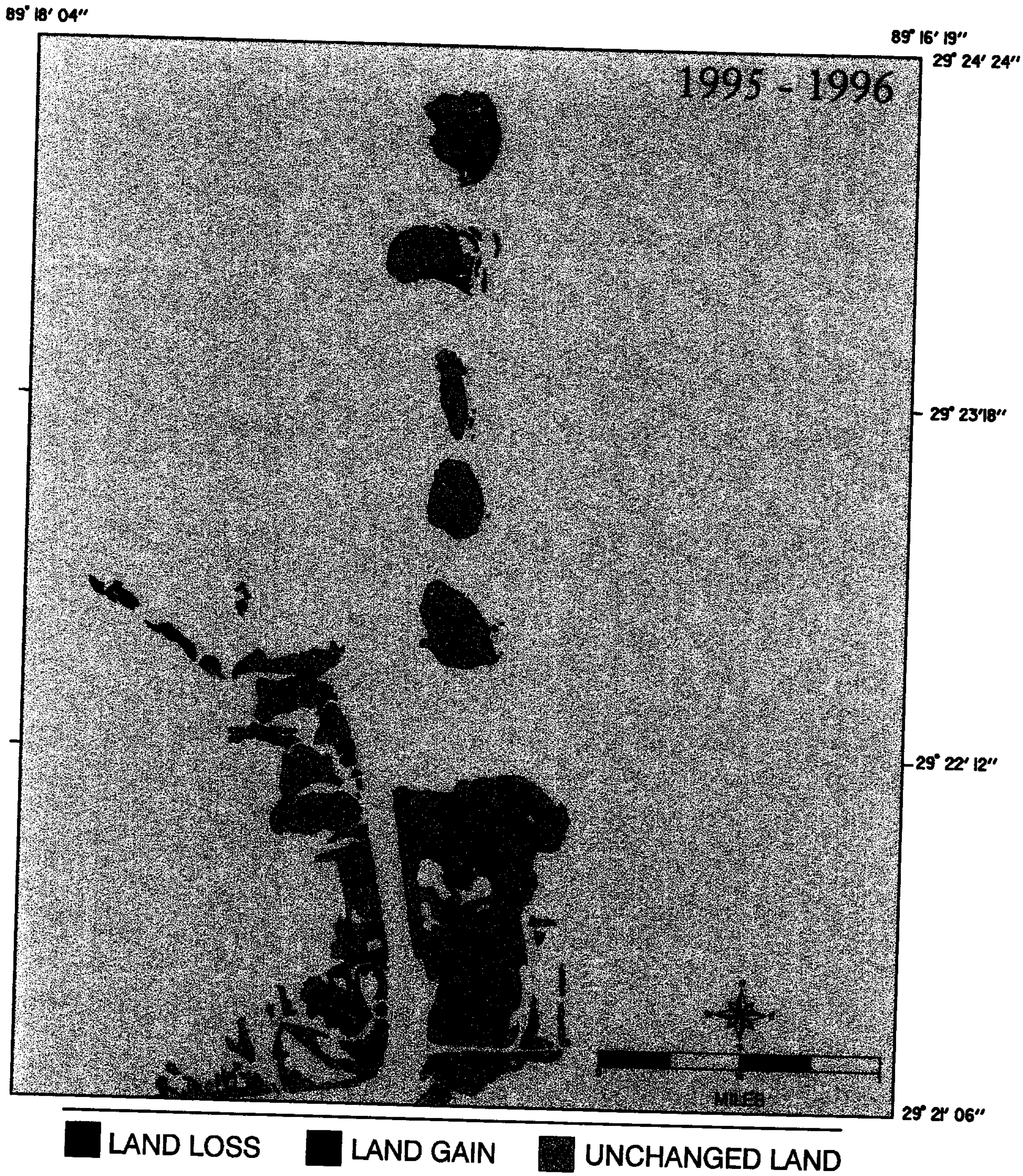


Figure 21. Shoreline change history for the Baptiste Collette Bayou BUMP study area between November 1995 and November 1996.

Habitat Inventory

The aerial photographic interpretation combined with field surveys identified six major habitat types in the Baptiste Collette Bayou BUMP study area. These habitats are further classified as natural and man-made. The natural class identifies natural deltaic processes as responsible for habitat creation. The man-made class identifies the habitats created by the beneficial use of dredged material. On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

Table 2 lists the areas of the three habitat types found in the study area in October 1975. The location and arrangement of these habitats is presented in figure 20. The total area of the Baptiste Collette Bayou BUMP study area was 125.71 acres. Of this total, 99.37 acres were natural and 26.34 acres were man-made, or 79.0 percent were natural and 21.0 percent were man-made. In order of decreasing size and importance, the largest habitat found was natural marsh (99.37 acres) followed by man-made marsh (18.16 acres), man-made shrub/scrub (5.01 acres), and man-made bare land (3.17 acres).

In terms of habitat totals, marsh (117.53 acres or 93.5%) dominated the landscape.

TABLE 2
October 1975 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	117.53	99.37	18.16
Shrub/Scrub	5.01	0.00	5.01
Bare Land	3.17	0.00	3.17
Habitat Total	125.71	99.37	26.34

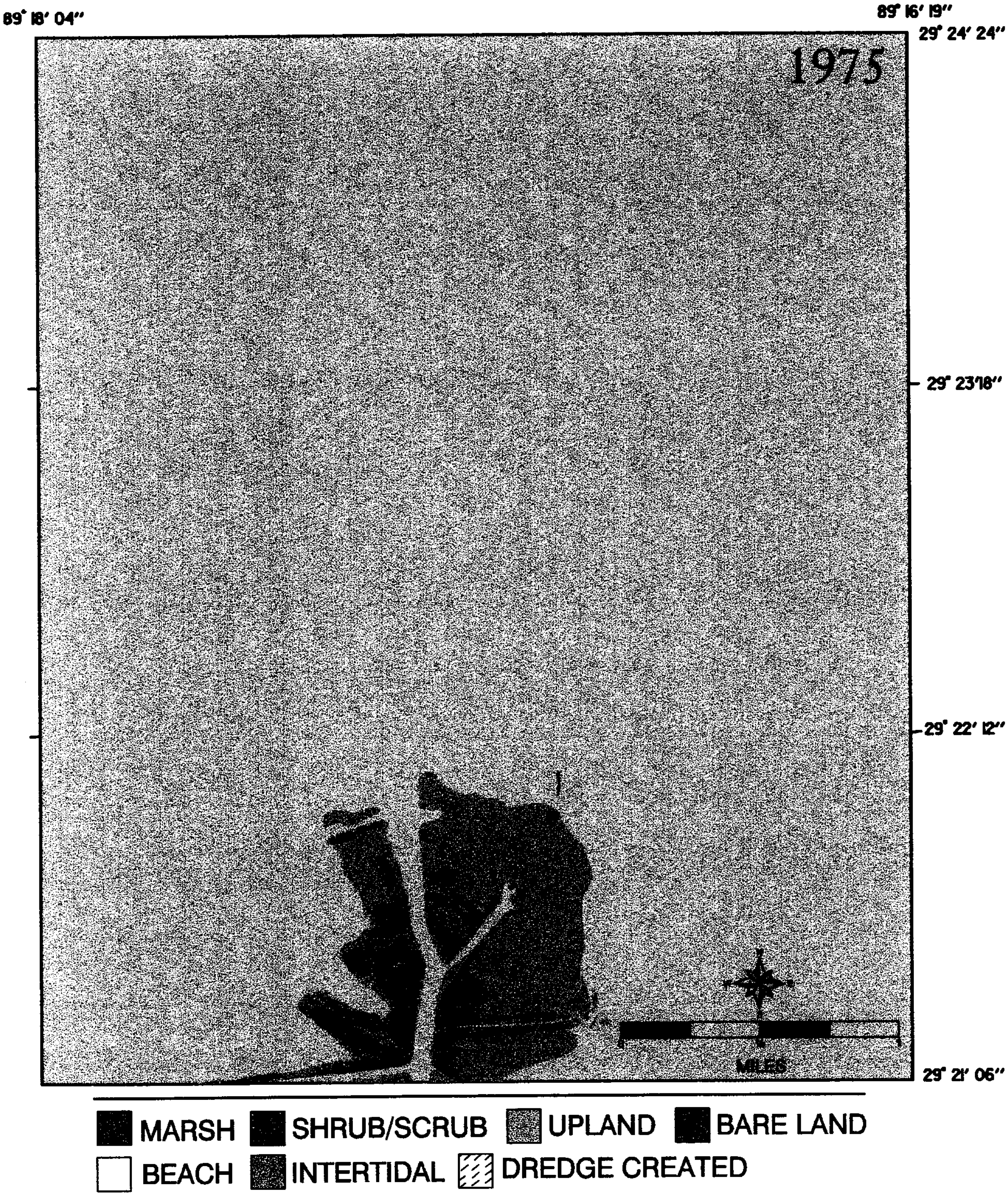


Figure 20. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in October 1975.

Table 3 lists the areas of the five habitat types found in the Baptiste Collette Bayou BUMP study area in December 1985. The location and arrangement of these habitats is presented in Figure 21. The total area of the Baptiste Collette Bayou study site was measured at 305.80 acres. Of this total, 89.08 acres were natural and 216.72 acres were man-made or 29.1 percent were natural and 70.9 percent were man-made. In order of decreasing size and importance, the largest habitat found was man-made marsh (136.53 acres) followed by natural marsh (82.17 acres), man-made bare land (45.60 acres), man-made upland (25.42 acres), natural bare land (6.91 acres), man-made beach (5.76 acres), and man-made shrub/scrub (3.41 acres).

In terms of habitat totals, marsh (218.70 acres or 71.5%) dominated the landscape.

TABLE 3
December 1985 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	218.70	82.17	136.53
Upland	25.42	0.00	25.42
Shrub/Scrub	3.41	0.00	3.41
Bare Land	52.51	6.91	45.60
Beach	5.76	0.00	5.76
Habitat Total	305.80	89.08	216.72

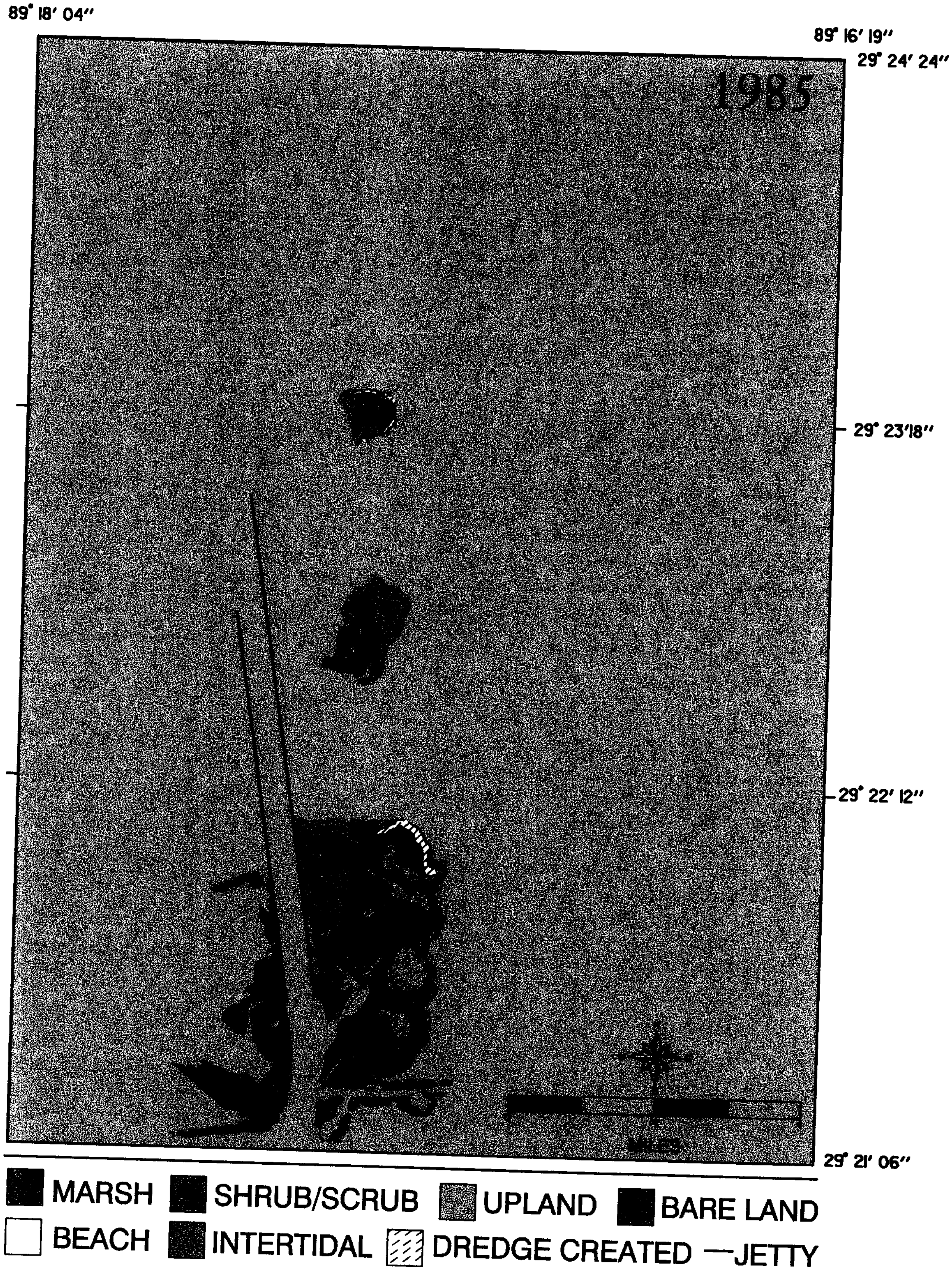


Figure 21. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in December 1985.

Table 4 lists the areas of the five habitat types found in the Baptiste Collette Bayou BUMP study area in December 1990. The location and arrangement of these habitats are presented in figure 22. The total area of the Baptiste Collette Bayou study site in December 1990 was 396.05 acres. Of this total, 88.29 acres were natural and 307.76 acres were man-made or 22.3 percent were natural and 77.7 percent were man-made. In order of decreasing size and importance, the largest habitat found was man-made marsh (182.04 acres) followed by natural marsh (71.00 acres), man-made bare land (55.95 acres), man-made shrub/scrub (36.50 acres), man-made upland (17.41 acres), natural bare land (16.46 acres), man-made beach (15.86 acres), and natural upland (0.83 acres).

In terms of habitat totals, marsh (253.04 acres or 63.9%) dominated the landscape.

TABLE 4
December 1990 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	253.04	71.00	182.04
Upland	18.24	0.83	17.41
Shrub/Scrub	36.50	0.00	36.50
Bare Land	72.41	16.46	55.95
Beach	15.86	0.00	15.86
Habitat Total	396.05	88.29	307.76

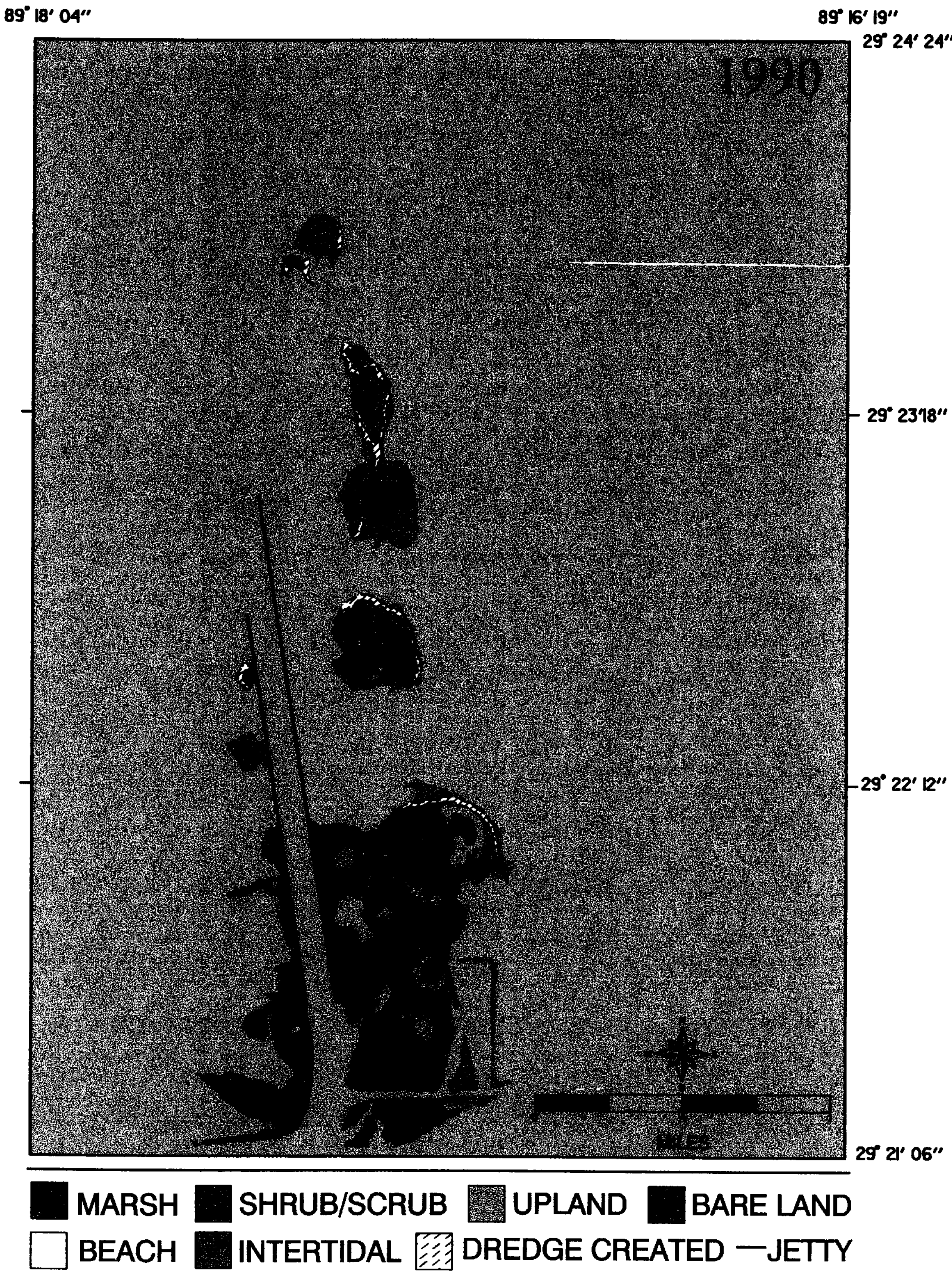


Figure 22. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in December 1990.

Table 5 lists the areas of the five habitat types found in the Baptiste Collette Bayou BUMP study area in February 1993. The location and arrangement of these habitats is presented in figure 23. The total area of the Baptiste Collette Bayou study site in February 1993 was 508.65 acres. Of this total, 82.41 acres were natural and 426.24 acres were man-made or 16.2 percent were natural and 83.8 percent were man-made. In order of decreasing size and importance, the largest habitat found was man-made marsh (200.85 acres) followed by man-made bare land (68.25 acres), natural marsh (69.35 acres), man-made upland (64.10 acres), man-made shrub/scrub (53.52 acres), man-made beach (39.52 acres), natural bare land (11.61 acres), and natural upland (1.45 acres).

In terms of habitat totals, marsh (270.20 acres or 53.1%) dominated the landscape.

TABLE 5
February 1993 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	270.20	69.35	200.85
Upland	65.55	1.45	64.10
Shrub/Scrub	53.52	0.00	53.52
Bare Land	79.86	11.61	68.25
Beach	39.52	0.00	39.52
Habitat Total	508.65	82.41	426.24

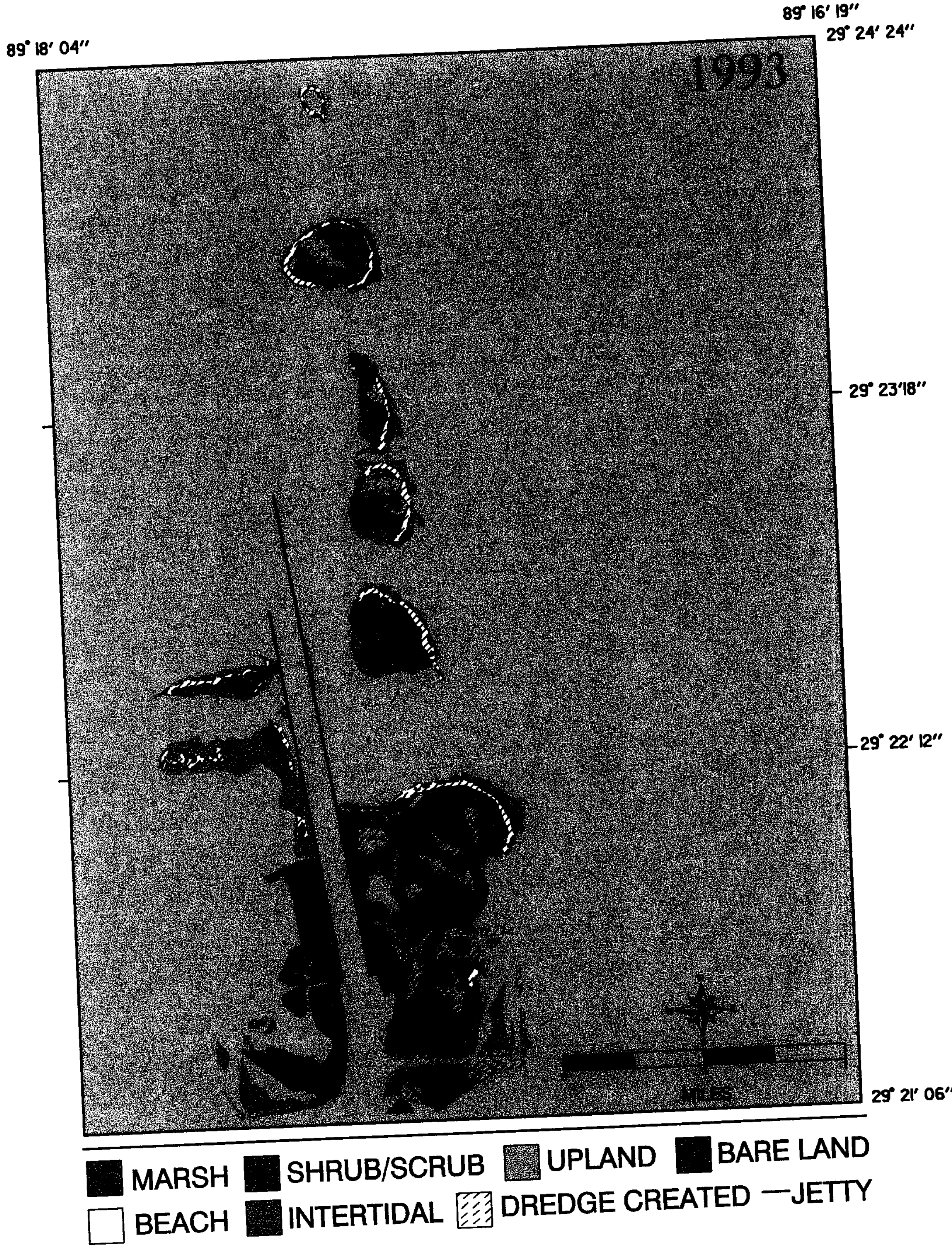


Figure 23. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in February 1993.

Table 6 lists the areas of the five habitats found in the Baptiste Collette Bayou BUMP study area in November 1994. The location and arrangement of these habitats is presented in figure 24. In 1994, the total area of the site was calculated at 623.18 acres. Of this total, 81.14 acres were natural and 542.04 acres were man-made, or 13.0 percent was natural and 87.0 percent was man-made. In order of decreasing size and importance, the largest habitat found is man-made marsh (291.88 acres) followed by man-made bare land (102.98 acres), man-made shrub/scrub (68.54 acres), man-made upland (65.88 acres), natural marsh (64.64 acres), natural upland (16.50 acres), and man-made beach (12.76 acres).

In terms of total area, marsh (356.52 acres or 57.2%) dominated the landscape of the study area.

TABLE 6
November 1994 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	356.52	64.64	291.88
Upland	82.38	16.50	65.88
Shrub/Scrub	68.54	0.00	68.54
Bare Land	102.98	0.00	102.98
Beach	12.76	0.00	12.76
Habitat Total	623.18	81.14	542.04

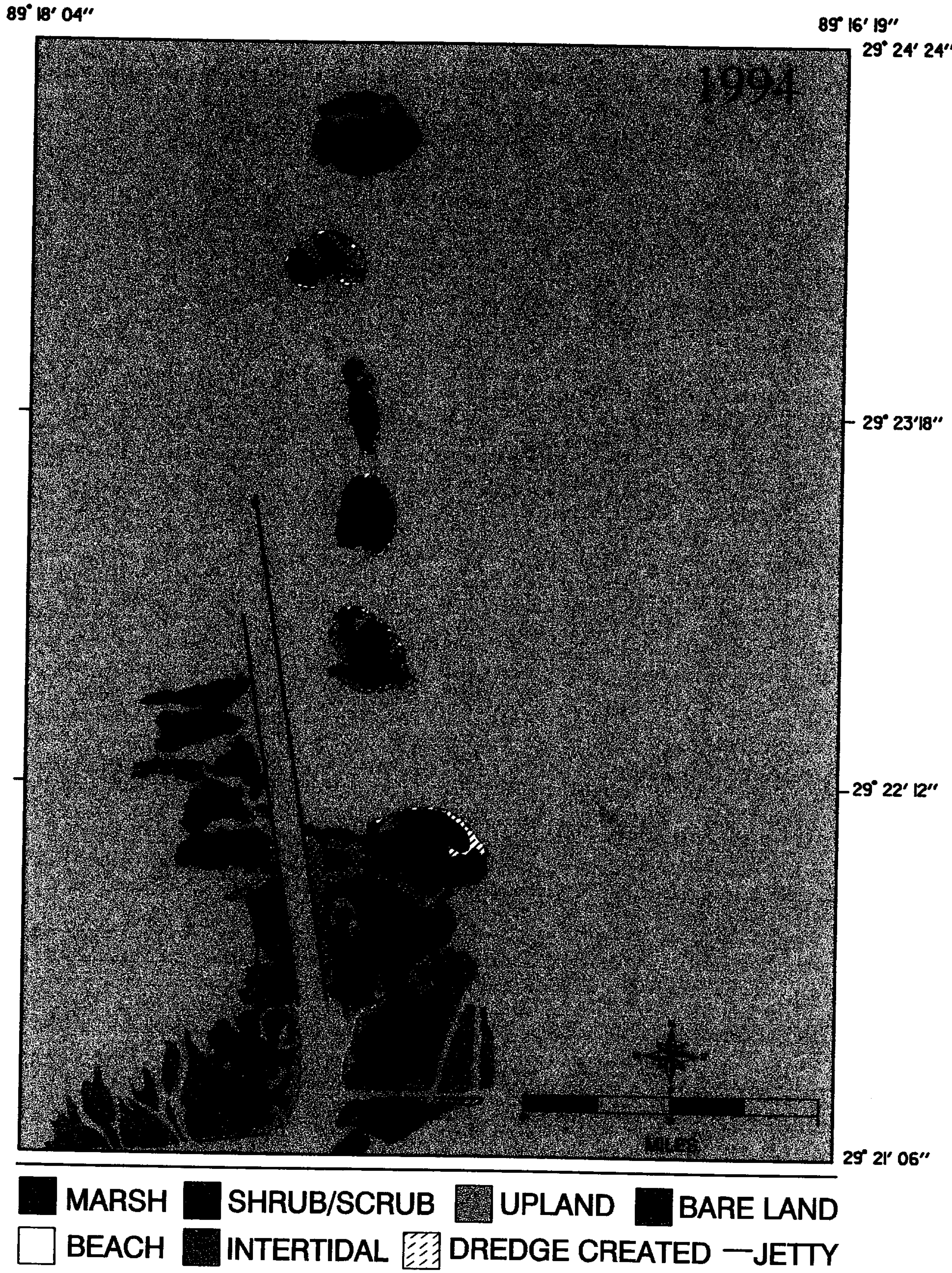


Figure 24. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in November 1994.

Table 7 lists the areas of the five habitats found in the Baptiste Collette Bayou BUMP study area in November 1995. The location and arrangement of these habitats is presented in figure 25. In 1995, the total area of the site was calculated at 581.63 acres. Of this total, 44.42 acres were natural and 537.21 acres were man-made, or 7.6 percent was natural and 92.4 percent was man-made. In order of decreasing size and importance, the largest habitat found is man-made marsh (255.37 acres) followed by man-made upland (114.39 acres), man-made shrub/scrub (68.88 acres), man-made beach (45.46 acres), man-made bare land (38.16 acres), natural marsh (36.93 acres), man-made dune (14.95 acres), natural upland (6.22 acres), and natural bare land (1.27 acres).

In terms of total area, marsh (292.30 acres or 50.3%) dominated the landscape of the study area.

TABLE 7
November 1995 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	292.30	36.93	255.37
Upland	120.61	6.22	114.39
Shrub/Scrub	68.88	0.00	68.88
Bare Land	39.43	1.27	38.16
Dune	14.95	0.00	14.95
Beach	45.46	0.00	45.46
Habitat Total	581.63	44.42	537.21

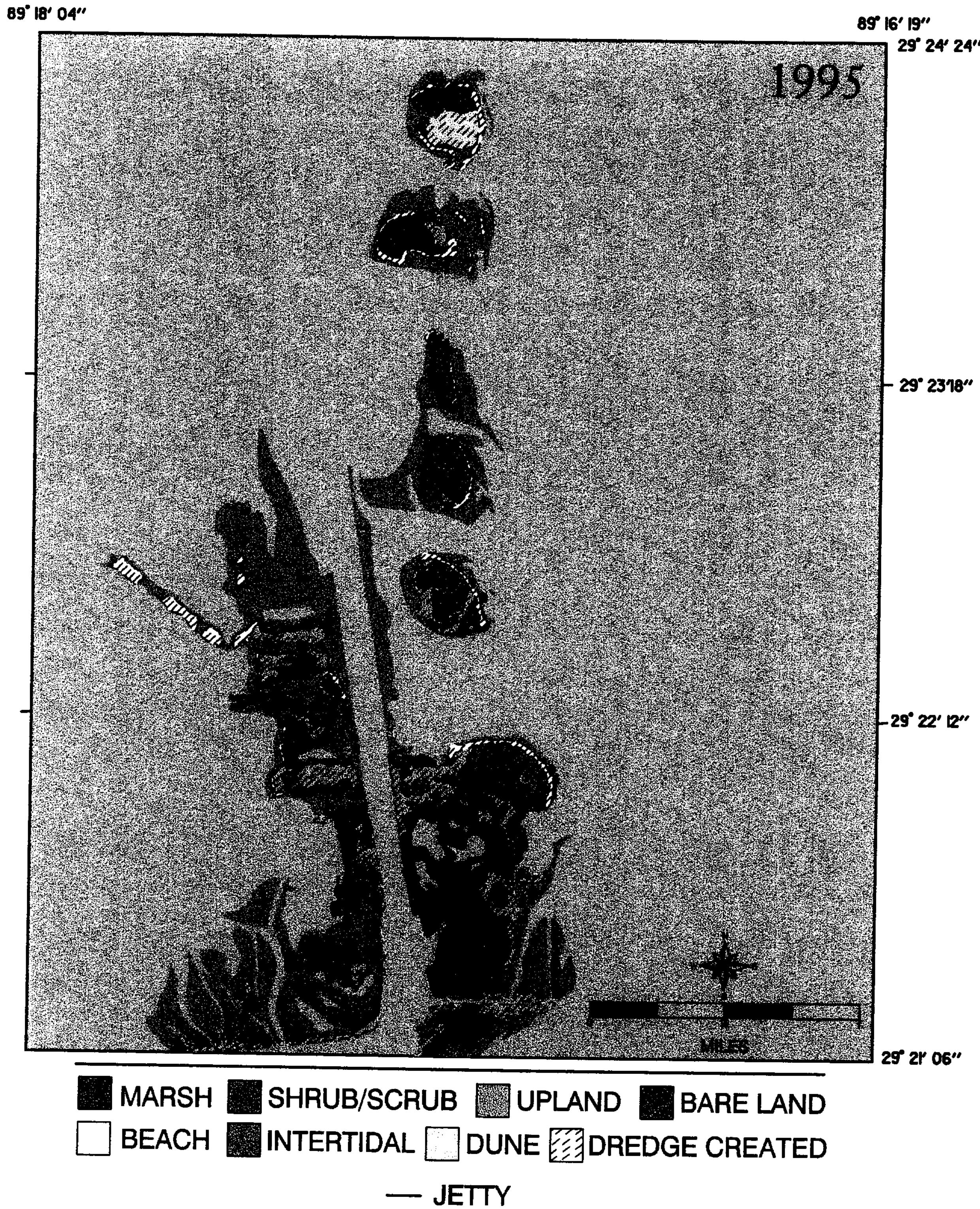


Figure 25. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in November 1995.

Table 8 lists the areas of the five habitats found in the Baptiste Collette Bayou BUMP study area in November 1996. The location and arrangement of these habitats is presented in figure 26. In 1996, the total area of the site was calculated at 588.86 acres. Of this total, 47.57 acres were natural and 541.29 acres were man-made, or 8 percent was natural and 92 percent was man-made. In order of decreasing size and importance, the largest habitat found is man-made marsh (212.5 acres) followed by man-made upland (120.07 acres), man-made bare land (107.68 acres), man-made shrub/scrub (59.84 acres), natural marsh (36.05 acres), man-made beach (33.78 acres), natural bare land (10.04 acres), man-made dune (7.42 acres), and natural upland (1.48 acres).

In terms of total area, marsh (248.55 acres or 42.2%) dominated the landscape of the study area.

TABLE 8
November 1996 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	248.55	36.05	212.50
Upland	121.55	1.48	120.07
Shrub/Scrub	59.84	0.00	59.84
Bare Land	117.72	10.04	107.68
Dune	7.42	0.00	7.42
Beach	33.78	0.00	33.78
Habitat Total	588.86	47.57	541.29

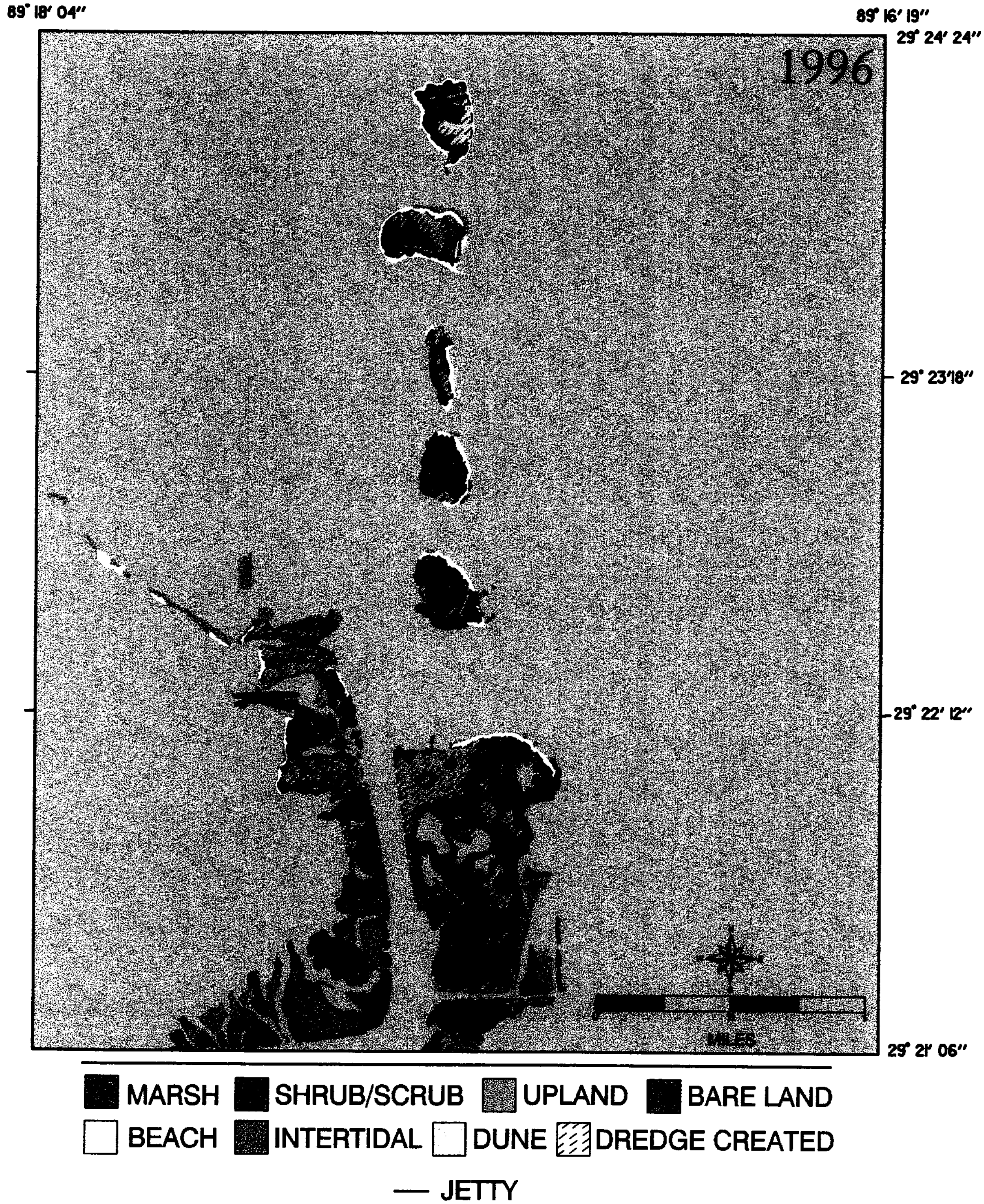


Figure 26. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in November 1996.

Habitat Change

Figure 27 shows the creation of new habitat, natural and man-made, along the study area by comparing October 1975 and November 1996. Land gain due to beneficial use of dredged materials dominates the processes of this area. The total area increased by +463.15 acres between 1975 and 1996 which represents a +368 percent increase in area. There was an overall -51.8 acres of decrease of the natural habitats, offset by an overall +514.95 acres of increase in man-made habitats. Table 9 lists the major habitat changes.

The greatest cumulative habitat change between 1975 and 1996 was the increase of man-made upland due to beneficial use of dredged materials. For the natural areas, there was a loss of -63.32 acres of marsh and a slight increase in bare land (+3.13 acres). The natural upland class increased by +1.48 acres. The total natural habitat changes accounted for -51.8 acres of loss. For the man-made habitats, in decreasing order, there was a gain of +120.07 acres of upland, +104.51 acres of bare land, +54.83 acres of shrub/scrub, and +33.78 acres of beach, and +7.42 acres of dune, for a total gain of +514.95. The overall change in natural and man-made habitats was an increase of +463.15 acres.

Figure 28 shows a time series of habitat changes along the Baptiste Collette Bayou navigation channel. Figure 28A graphs the natural habitat changes over time. Natural marsh degradation and erosion dominates the processes affecting the natural habitat class. Figure 28B graphs the man-made marsh, man-made shrub/scrub and man-made bare land that dominate the man-made class. In terms of the beneficial use process, the greatest areas of new habitat creation include man-made upland (+94.76 acres), and man-made marsh (+75.99 acres) as indicated by the most recent inventory in November 1996 (Table 8).

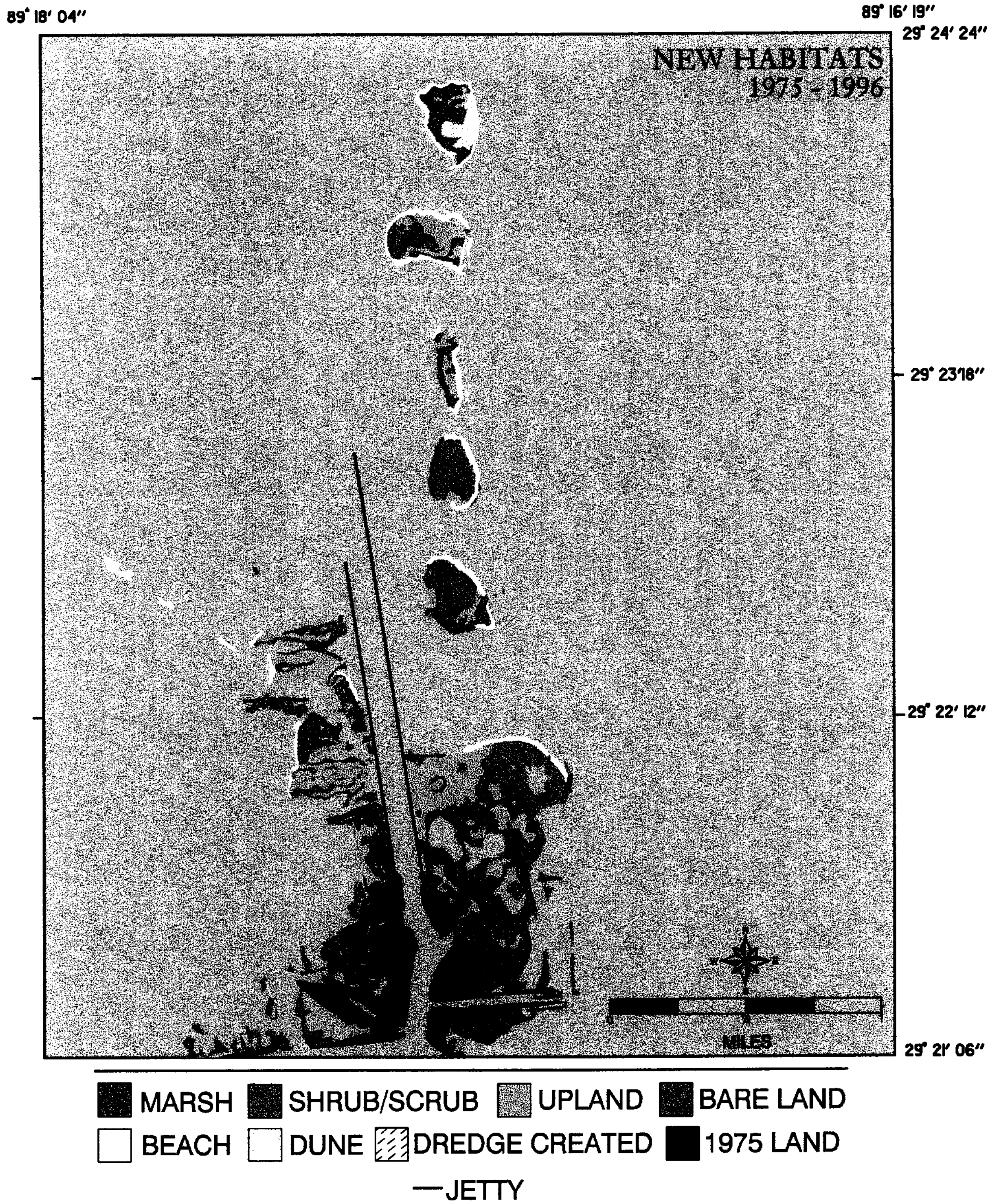
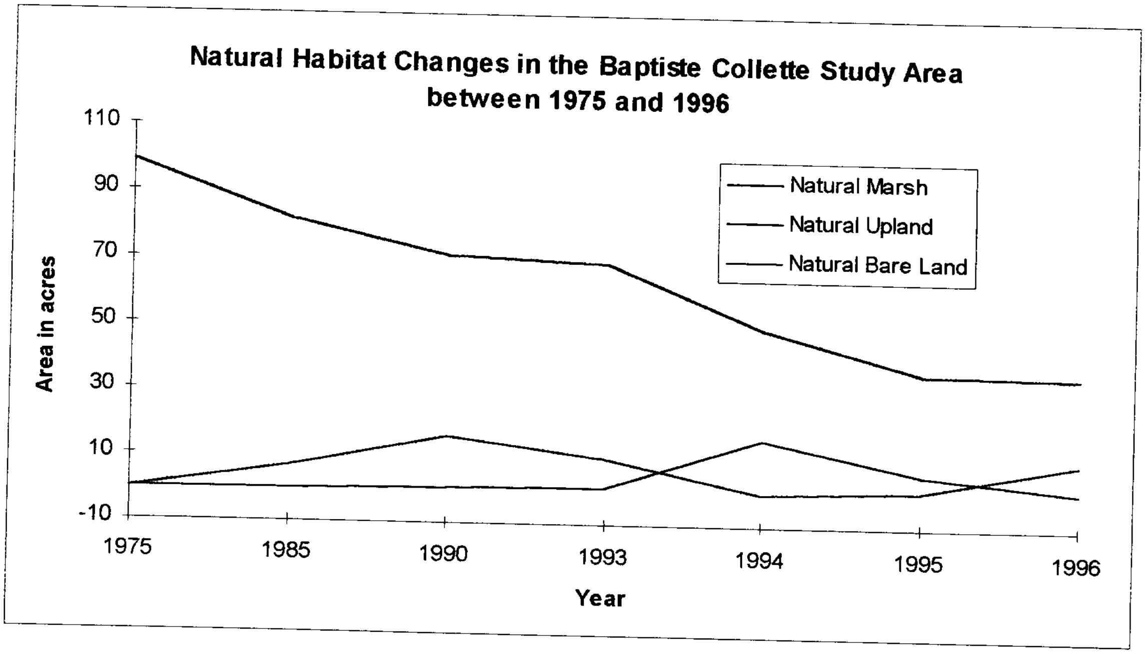


Figure 27. New habitats created by beneficial use of dredged materials in the Baptiste Collette Bayou BUMP study area comparing October 1975 and November 1996.

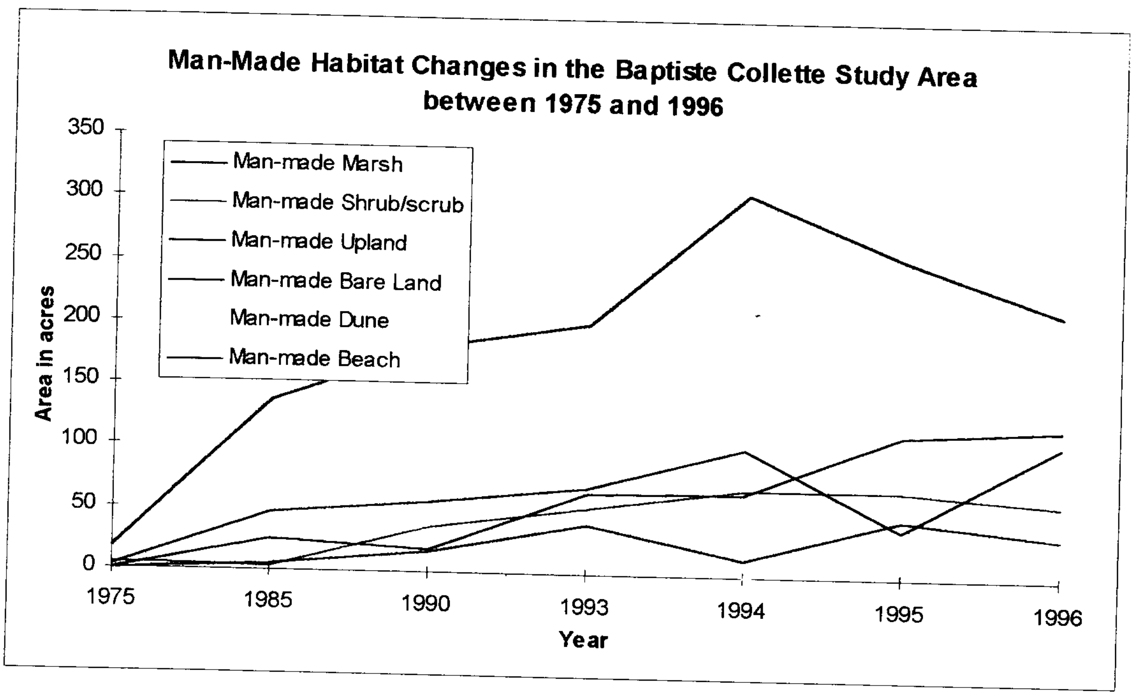
TABLE 9
Cumulative Change in Total Acres of each Habitat
In the Study Area Between 1975, 1985, 1990, 1993, 1994, 1995 and 1996

HABITAT	1975-1985[1]	1985-1990[1]	1990-1993[1]	1993-1994[1]	1994-1995[1]	1995-1996[1]	1975-1996[1]
Natural Marsh	-17.20	-11.17	-1.65	-4.71	-27.71	-0.88	-63.32
Natural Upland	0.00	+0.83	+0.62	+15.05	-10.28	-4.74	+1.48
Natural Bare Land	+6.91	+9.55	-4.85	-11.61	+1.27	+8.77	+10.04
Total Natural Habitats	-10.29	-0.79	-5.88	-1.27	-36.72	+3.15	-51.8
Man-made Marsh	+118.37	+45.51	+18.81	+91.03	-36.51	-255.37	+194.34
Man-made Upland	+25.42	-8.01	+46.69	+1.78	+48.51	+5.68	+120.07
Man-made Shrub/Scrub	-1.60	+33.09	+17.02	+15.02	+0.34	-9.04	+54.83
Man-made Bare Land	+42.43	+10.35	+12.30	+34.73	-64.82	+69.52	+104.51
Man-made Dune	--	--	--	--	+32.70	-11.68	+7.42
Man-made Beach	+5.76	+10.10	+23.66	-26.76	+14.95	-7.53	+33.78
Total Man-made Habitats	+190.38	+91.04	+118.48	+115.86	-4.83	+4.08	+514.95
HABITAT TOTAL	+180.09	+90.25	+112.60	+114.53	-41.55	+7.23	+463.15

[1] in acres



A



B

Figure 28. Time series showing the changes in total area of each habitat in the Baptiste Collette Bayou BUMP study area between October 1975 and November 1996. A) natural habitat changes. B) man-made habitat changes.

Figure 29 documents the creation of habitats at the BCB BUMP study area between October 1975 and December 1985. For the natural habitats there was a loss of -17.20 acres of marsh and a gain of +6.91 of bare land for a net change of -10.29 acres. For the man-made habitats, in decreasing order, there was a gain of +118.37 acres of marsh, +42.43 acres of bare land, +25.42 acres of upland, and +5.76 acres of beach. There was a loss of -1.60 acres of man-made shrub/scrub resulting in a total net gain of +190.38 acres. Overall, the total BCB study area increased in size by +180.09 acres for this ten year period.

Figure 30 documents the creation of habitats at the BCB BUMP study area between December 1985 and December 1990. For the natural habitats, there was a loss of -11.17 acres of marsh and a gain of +0.83 acres of upland and +9.55 acres of bare land for a total decrease of -0.79 acres. For the man-made areas, in decreasing order, there was a gain of +45.51 in marsh, +33.09 acres of shrub/scrub, +10.35 acres of bare land, and +10.10 acres of beach. There was a -8.01 acres decrease in man-made upland. The total man-made changes in the BCB study area was a gain of +91.04 acres. Overall, the BCB study area increased in size by +90.25 acres for this five year period.

Figure 31 documents the creation of habitats of the BCB BUMP study area between December 1990 and February 1993. This did not include areas created as a result of the FY93 maintenance event that took place between August and October 1993. For the natural habitats there was a loss of -1.65 acres of marsh and -4.85 acres of bare land. There was a gain of +0.62 acres of natural upland. The total natural changes amounted to a decrease of -5.88 acres. For the man-made habitat, in decreasing order, there were gains of +46.69 acres of upland, +23.66 acres of beach, +18.81 acres of marsh, +17.02 acres of shrub/scrub, and +12.30 acres of bare land. The total man-made changes accounted for a gain of +118.48 acres. The overall BCB study area increased in size by +112.60 acres over this two year period.

Figure 32 documents the creation of habitats in the BCB BUMP study area between February 1993 and November 1994, which includes the results of both FY93 and FY94 maintenance events. For the natural habitats, there was a loss of -4.71 acres of marsh and -11.61 acres of bare land. There was a +15.05 acres increase in the natural upland class. The total change in natural habitats was a decrease of -1.27 acres. For the man-made habitats, in decreasing order, there was a gain of +91.03 acres of marsh, +34.73 acres of bare land, +15.02 acres of shrub/scrub, and +1.78 acres of upland. There was a loss for man-made habitats of -26.76 acres of beach. The total man-made habitat change was a gain of +115.80 acres. The overall study area increased in size by +114.53 acres over this two year period.

Figure 33 documents the creation of habitats in the BCB BUMP study area between November 1994 and November 1995, which includes the results of the FY95 maintenance event. For the natural habitats, there was a loss of -27.71 acres of marsh and a gain of +1.27 acres of bare land. There was a -10.28 acres decrease in the natural upland class. The total change in natural habitats was a decrease of -36.72 acres. For the man-made habitats, there were changes of -36.51 acres of marsh, -64.82 acres of bare land, +0.34 acres of shrub/scrub, and +48.51 acres of upland. There was a gain for man-made habitats of +32.70 acres of beach. The total man-made habitat change was a loss of -4.83 acres. The overall study area decreased in size by -41.55 acres over this one year period.

Figure 34 documents the creation of habitats in the BCB BUMP study area between November 1995 and November 1996, which includes the results of the FY96 maintenance events. For the natural habitats, there was a loss of -0.88 acres of marsh and -4.74 acres of upland. There was a +8.77 acres increase in the natural bare land class. The total change in natural habitats was an increase of +3.15 acres. For the man-made habitats, there were changes of -255.37 acres of marsh, +69.52 acres of bare land, -9.04 acres of shrub/scrub, and +5.68 acres of upland. There was a loss for man-made habitats of -11.68 acres of beach. The total man-made habitat change was a gain of +4.08 acres. The overall study area increased in size by +7.23 acres over this one year period.

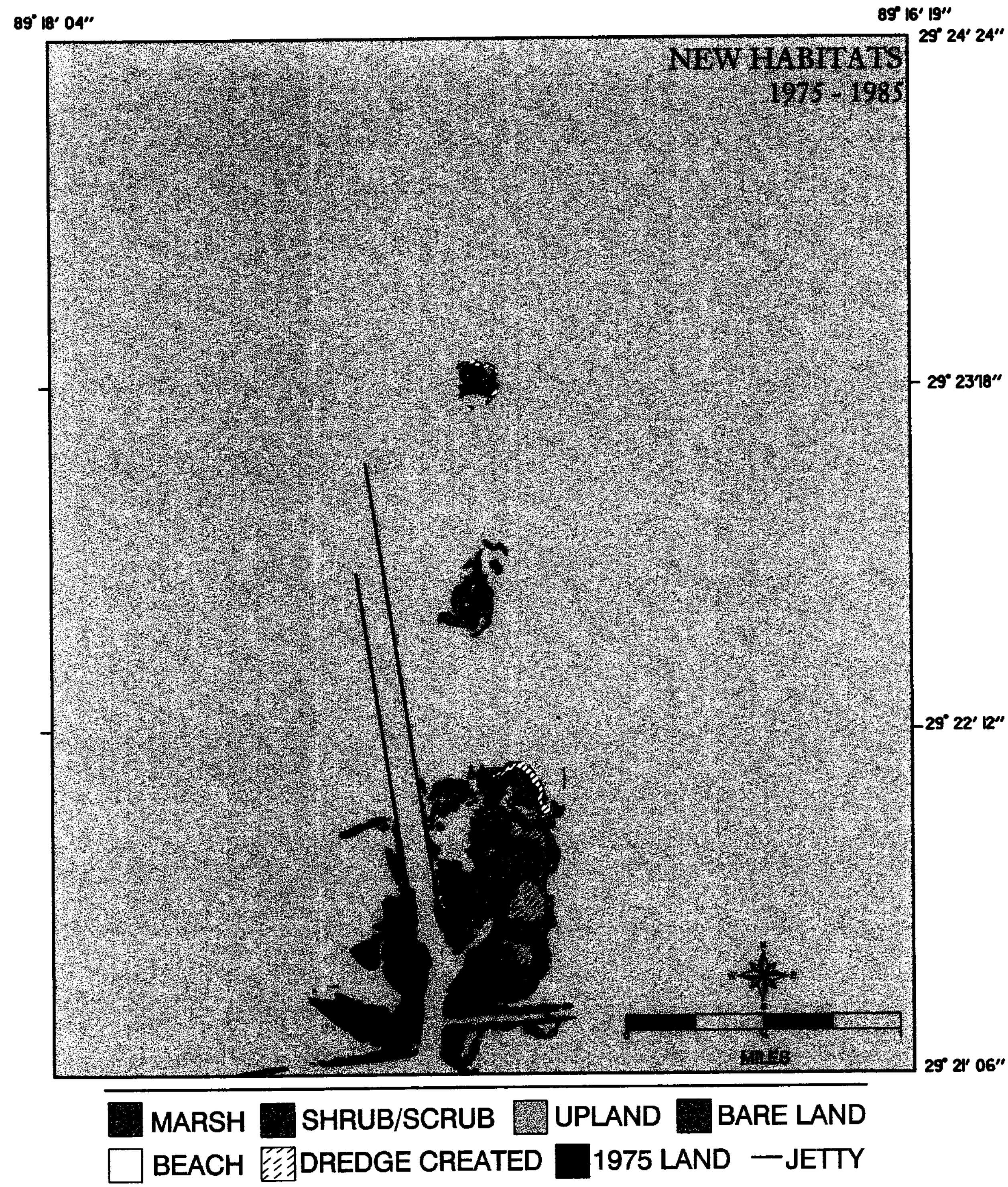


Figure 29. New habitats created as a result of the beneficial use of dredged material in the Baptiste Collette Bayou study area, shown by comparing October 1975 and December 1985.

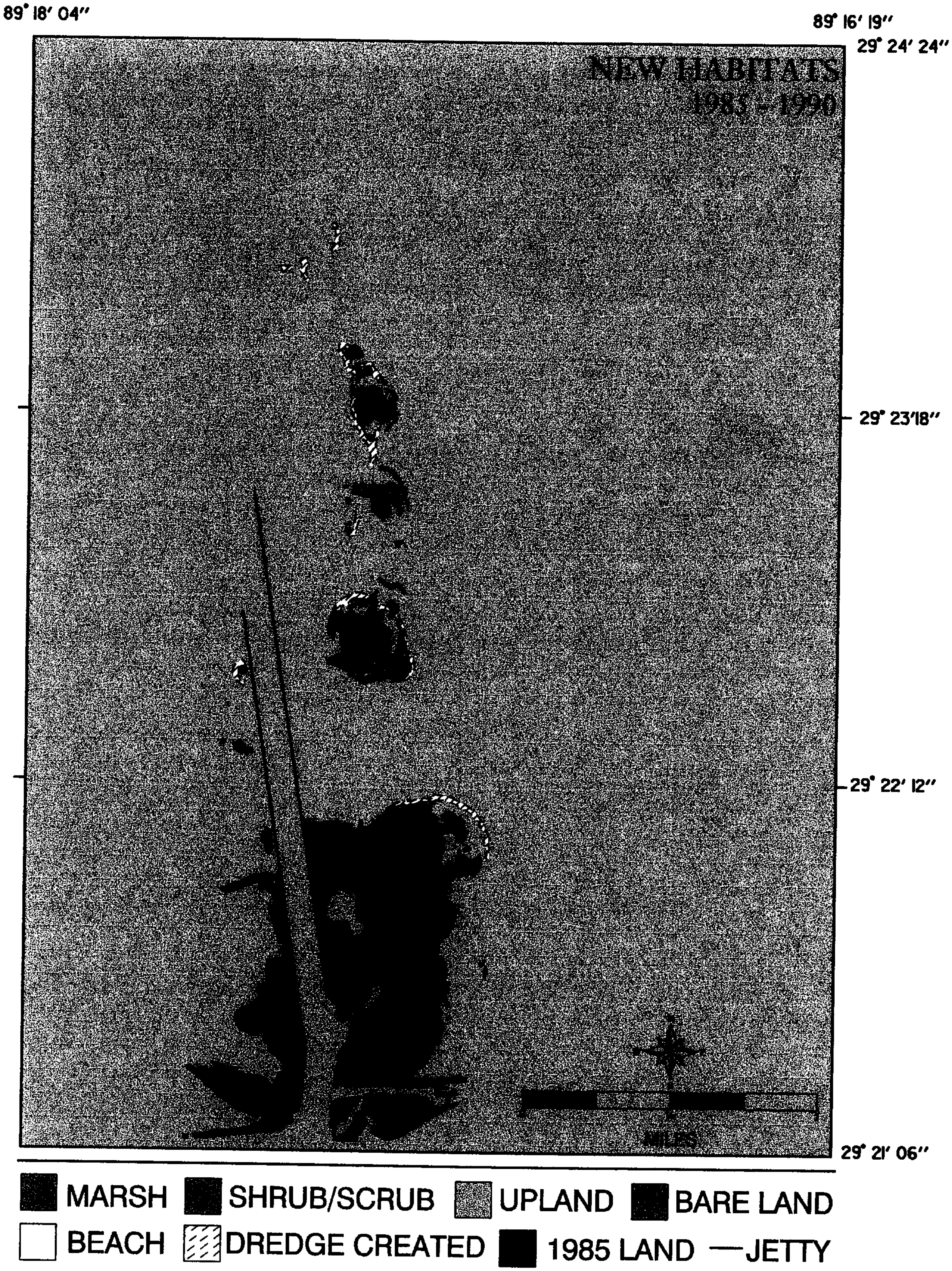


Figure 30. New habitats created as a result of the beneficial use of dredged material in the Baptiste Collette Bayou study area, shown by comparing December 1985 and December 1990.

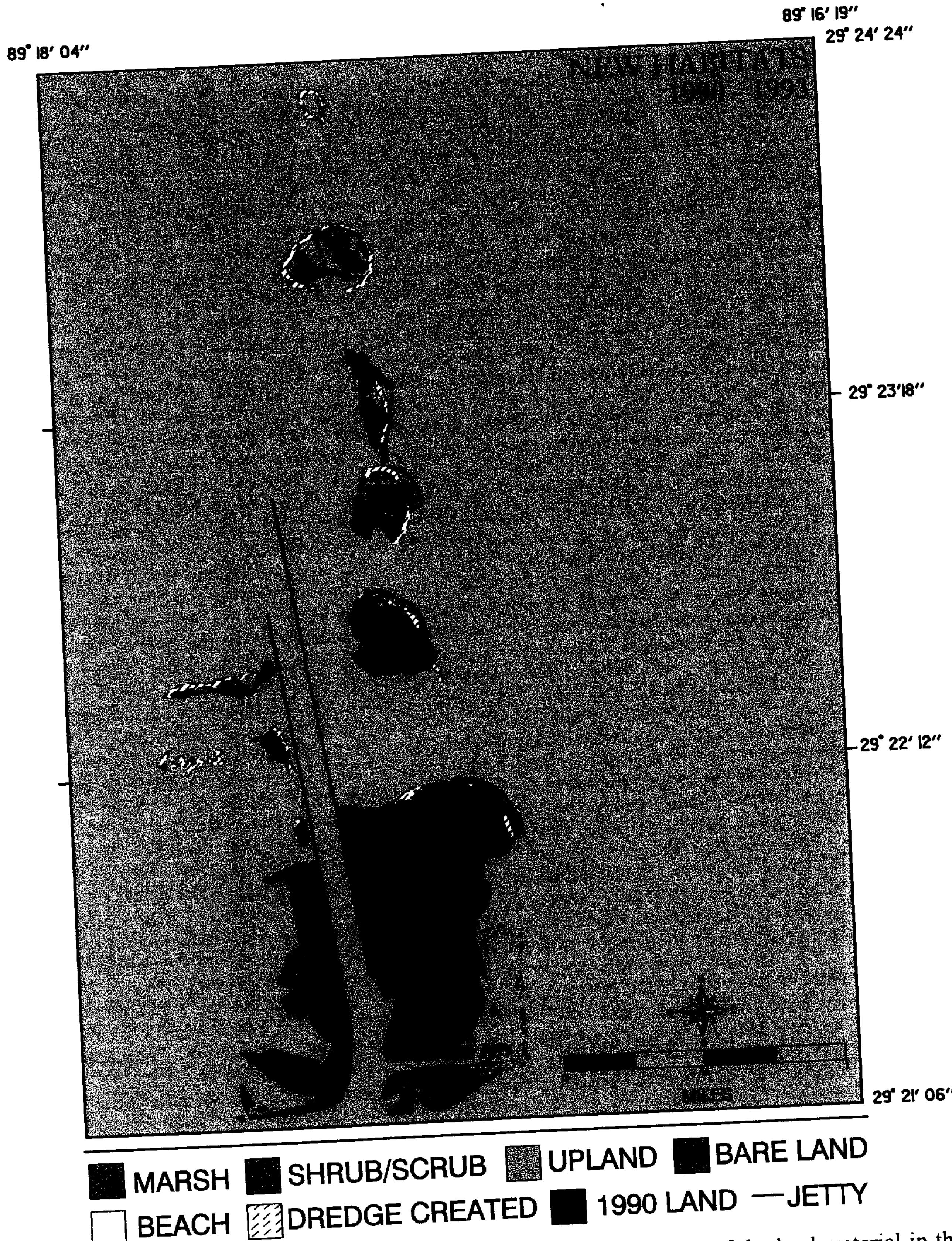


Figure 31. New habitats created as a result of the beneficial use of dredged material in the Baptiste Collette Bayou study area, shown by comparing December 1990 and February 1993.

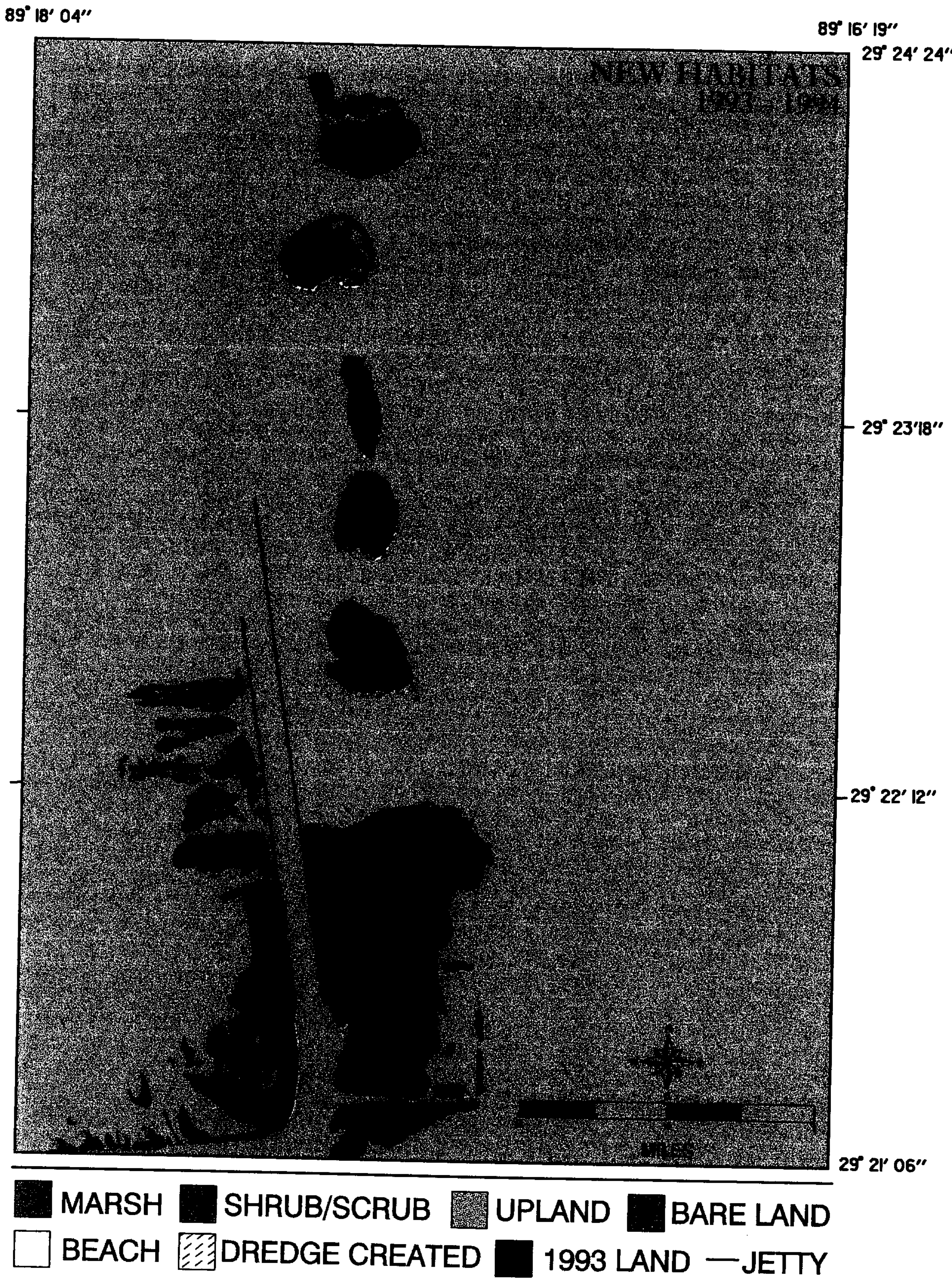


Figure 32. New habitats created as a result of the beneficial use of dredged material FY93 and FY94 maintenance events in the Baptiste Collette Bayou study area, shown by comparing February 1993 and November 1994.

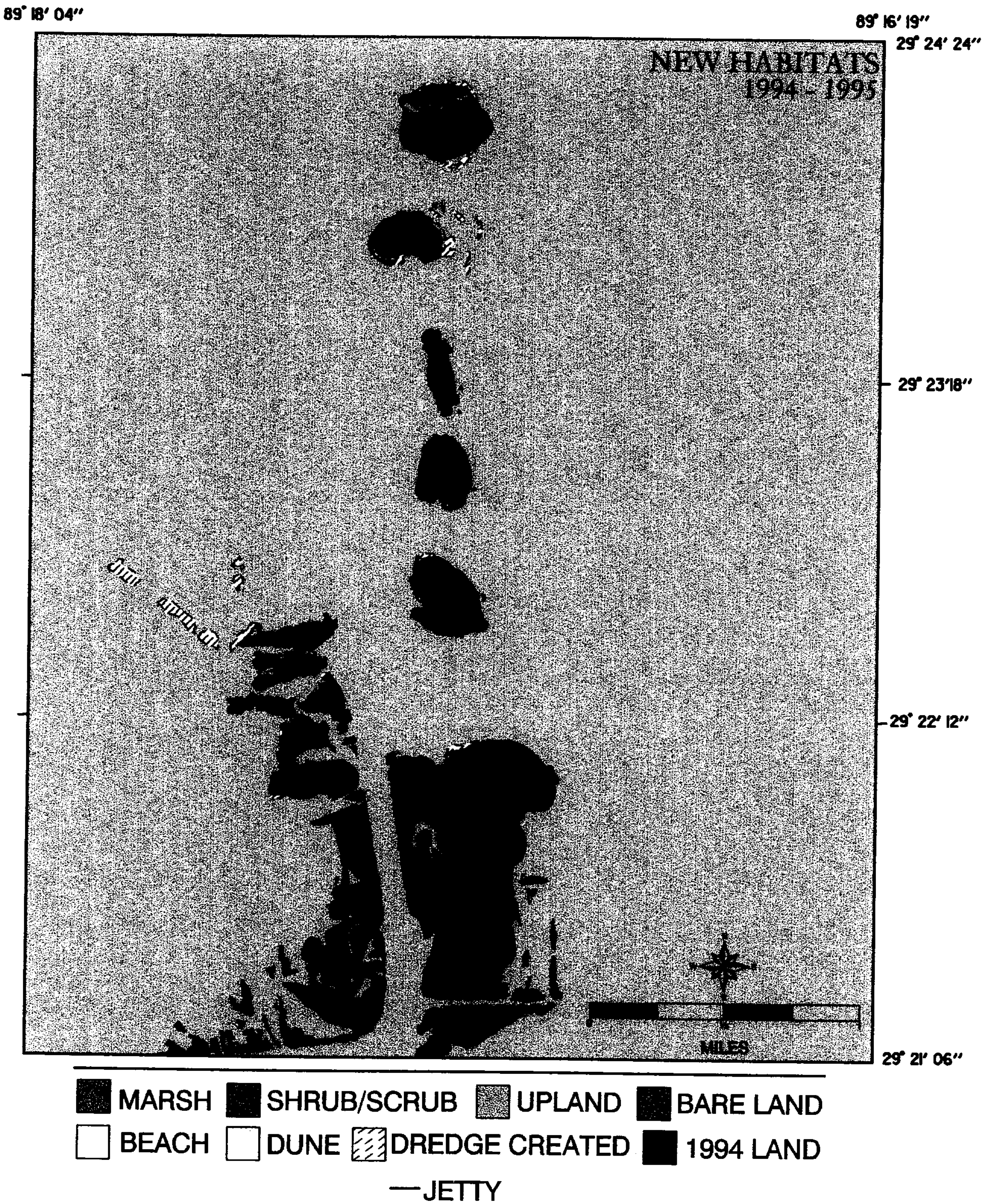


Figure 33. New habitats created as a result of the beneficial use of dredged material FY95 maintenance event in the Baptiste Collette Bayou study area, shown by comparing November 1994 and November 1995.

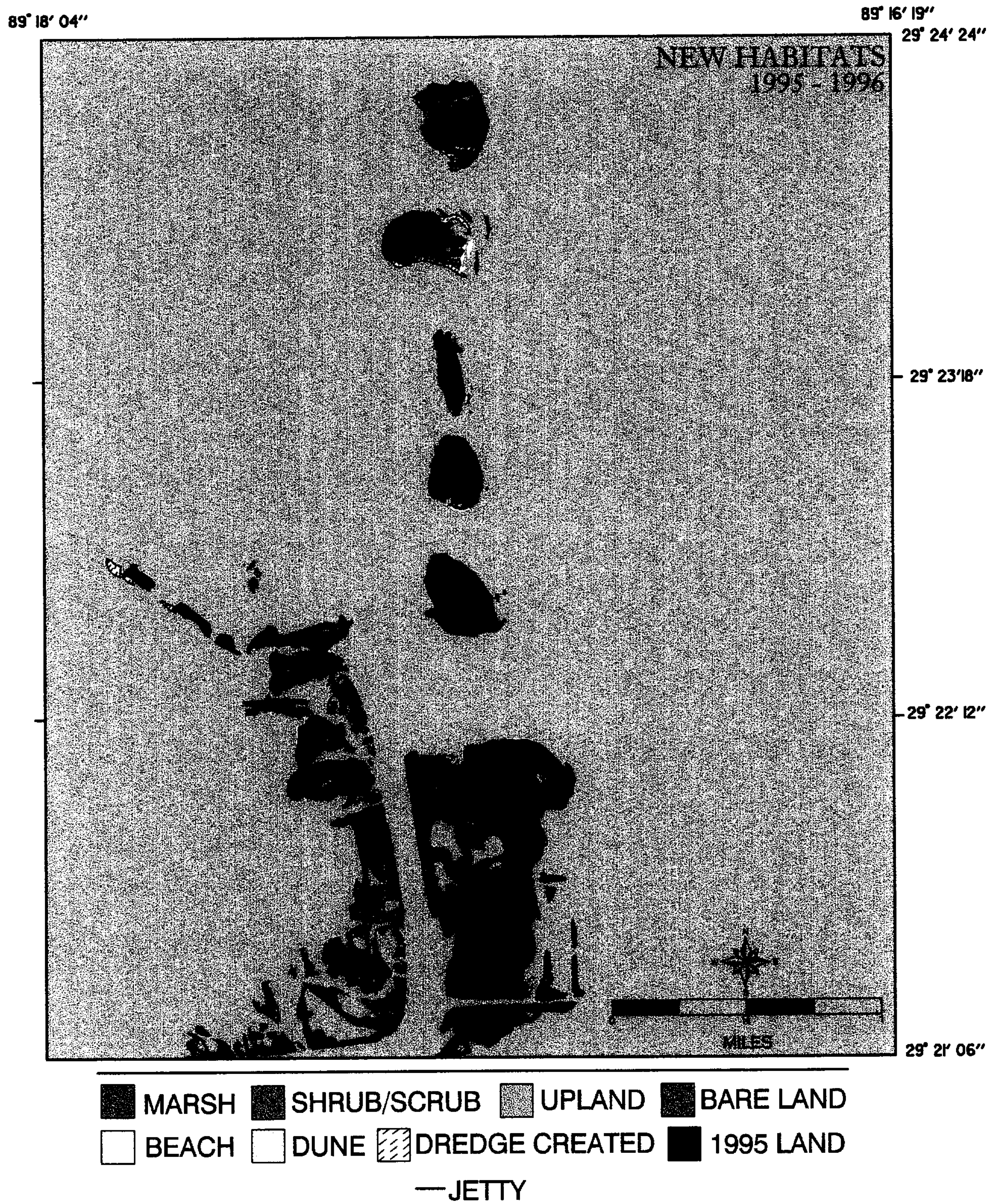


Figure 34. New habitats created as a result of the beneficial use of dredged material FY96 maintenance event in the Baptiste Collette Bayou study area, shown by comparing November 1995 and November 1996.

CONCLUSIONS

1. The beneficial use of dredged material at the BCB navigation channel has been very successful in creating new habitats and has accelerated the growth of this Mississippi River distributary since 1975.

2. The beneficial use of dredged material has created +324.57 acres of man-made habitats between 1975 and 1996. In contrast, the natural habitats in the study area have decreased by -41.51 acres. The resultant total increase in area of the BCB area is +283.06 acres. This increase in area is a result of bird island, wetland, and other habitat creation as a result of the beneficial use of dredged material. Over +75.97 acres of marsh have been created since 1975, which accounts for 23% of the new habitats created. The field surveys also documented that the seaward islands were subject to erosion on their margins, particularly the eastern facing shorelines. These islands were also subject to decreases in elevation due to settlement and overwash processes.

3. The field surveys indicated that the marshes created consist of a mixture of salt marsh through fresh marsh species and should be classed as intermediate marshes. The field surveys also documented that the optimum elevation for marsh development is less than 3 feet msl (3.78 feet Mean Low Gulf).

4. The habitat inventory documented a change from a study area primarily dominated by natural habitats in 1975 to primarily man-made habitats in 1996. In 1975, the study area contained 125.71 acres of which 79% was natural and 21% was man-made. In 1996, the study area contained 588.86 acres of which 9% was natural and 91% was man-made.

5. The habitat change analysis indicated that +75.97 acres of man-made marsh was created through the beneficial use of dredged material. Other significant habitat increases include +62.08 acres of man-made bare land, +94.65 acres of man-made upland, and +56.43 acres of man-made shrub/scrub.

6. The most successful time period for marsh creation occurred between February 1993 and November 1994 when +91.03 acres were created in a little under two years which approximates a rate of +52.02 acres per year. Prior to 1993, the annual rate of marsh creation averaged +11.3 acres per year. This very successful year of marsh creation is a function of beneficially placing the dredged material in unconfined sediment peninsulas to the west of the BCB navigation channel. In contrast, the period 1994 to 1996 saw a tremendous loss in man-made marsh, a decrease of -291.88 acres. This loss is related to the increased storm activity during this time period.

REFERENCES

Morgan, Joel David, 1977. The Mississippi River Delta - Legal-Geomorphic evaluation of historic shoreline changes in *Geoscience and Man*, Vol. 15, School of Geoscience, Louisiana State University, Baton Rouge, Louisiana.

Wayne, L.D., Penland, S., Westphal, K.A., Hiland, M.W., Connor, P., and Zganjar, C., 1995. The development of a coastal monitoring program to document the beneficial use of navigation dredge materials in the U.S. Army Corps of Engineers - New Orleans District: Baptiste Collette Bayou Pilot Study. Final Report, U.S. Army Corps of Engineers, 34 pp.

APPENDIX 5A
LIST OF VEGETATIVE SPECIES
OF THE BAPTISTE COLLETTE BAYOU STUDY AREA

LIST OF VEGETATIVE SPECIES
OF THE BAPTISTE COLLETTE BAYOU STUDY AREA

An alphabetical list of observed and collected plant species follows. This list is not complete, but is meant to establish vegetative character and indicate dominant species observed. The list includes the year of observation, species name, alternate scientific names, common names, and general habitat description for each plant. The habitat information was taken from the Manual of the Vascular Flora of the Carolinas or The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts.

- \- Observed in 1994
- • Observed in 1995
- \+ Added in 1996

• **Atriplex pentandra** (Jacq.) Standl. . . . . seabeach orach
(Atriplex arenaria)
annual; sand dunes along the coast

\- **Acmella oppositifolia** (Lam.) R.K. Jansen var. **repens** . . . . creeping spotflower
(Spilanthes americana)
colonial perennial; wet pastures, swamp forests, river banks

• - **Aeschynomene indica** L. . . . . joint-vetch shrub
Annual; swamps, fresh marshes

\- **Alternanthera philoxeroides** (Mart.) Griseb. . . . . alligator-weed
perennial herb; fresh or intermediate aquatic or very wet habitats

\- **Amaranthus australis** (Gray) Sauer . . . . Gulfcoast water-hemp, belle dame
(Acnida cuspidata)
annual; brackish or intermediate marsh

\+ **Amaranthus palmeri** Watson . . . .
Annual; fields and sandhills

• - **Amaranthus tuberculatus** (Moq.) Sauer . . . . water-hemp
annual;

\- **Ammania coccinea** Rottb. . . . . toothcup, purple ammania
succulent annual; fresh and brackish marshes, margins of ponds

\- **Aster subulatus** Michx. . . . . annual saltmarsh aster
annual; fresh to brackish marsh

• - **Aster tenuifolius** L. . . . . perennial saltmarsh aster
perennial; fresh to brackish marsh

\- **Bacopa monnieri** (L.) Pennell . . . . coastal water-hyssop
succulent creeping perennial; swales, sloughs, ditches, sand flats, sandy margins of fresh or brackish marshes, streams, ponds

• - **Baccharis halimifolia** L. . . . . groundselbush
shrub; elevated sites in fresh to saline marshes

\- **Bidens frondosa** L. . . . . beggar-ticks
annual; fields, pastures, alluvial woods, fresh marsh and waste places

\- **Bidens laevis** (L.) B.S.P. . . . . bur-marigold, smooth beggar-tick
perennial; fresh marsh and stream banks

• **Cakile constricta** Rodman . . . . sea rocket
annual; coastal sand dunes

\- **Chamaesyce humistrata** (Engelm. ex Gray) Small . . . . spurge
prostrate annual;

\- **Chenopodium ambrosioides** L. . . . . Mexican tea
annual; cultivated fields, pastures, waste places

- Cichorium intybus L. .... chicory
  perennial herb; old fields, roadsides, waste places

• **Conyza canadensis** (L.) Cronq. .... horseweed, hogweed, butterweed
  (Erigeron canadensis)
  annual; fields, roadsides, pastures and waste places

• - **Colocasia antiquorum** .... elephantsear
  Perennial; fresh marsh, pond and stream margins

• - **Cynodon dactylon** (L.) Pers. .... Bermuda grass
  rhizomatous perennial; fields, roadsides, waste places

+ **Cyperus articulatus** L. ....
  Perennial; marshes

- **Cyperus difformis** L. .... variable flatsedge

• **Cyperus elegans** L. .... nutsedge

• **Cyperus erythrorhizos** Muhl. .... ivory nutsedge
  annual; marshes and ditches

• **Cyperus esculentus** L. .... yellow nutgrass
  perennial; sandy fields, roadsides, and waste places

+ **Cyperus iria** L. ....
  annual; marshes, ditches and low waste places

• - **Cyperus odoratus** L. .... flagrant flatsedge
  perennial; fresh and intermediate marsh, swales, pond margins, ditches

• - **Cyperus oxylepis** Nees es Steud. .... sharp-scale flatsedge

+ **Cyperus strigosus** L. ....
  coarse perennial; marshes, ditches and low wastw places

+ **Desmanthus illinoensis** (Michx.) Macm. .... Prairie mimosa
  herbaceous perennial; disturbed fields and roadsides

• **Digitaria ciliaris** (Retz.) Koel. .... crab grass
  annual; sandy fields, roadsides, waste places

• - **Distichlis spicata** (L.) Greene .... salt grass
  rhizomatous perennial; brackish marshes and flats

+ **Echinochloa muricata** (Beauv.) Fern. .... barnyard grass
  low fields, marshes and waste places

• - **Echinochloa walteri** (Pursh) Heller .... Walter's millet
  coarse annual; fresh and intermediate marshes and low waste places

+ **Eclipta alba** (L.) Hassk. .... eclipta
  annual; pond shores, alluvial meadows, marshes, low woods and bogs

• - **Eclipta prostrata** (L.) L. (Eclipta alba) .... Yerba de Tajo
  prostrate annual; pond shores, alluvial meadows, marshes, low woods and bogs

- **Eichhornia crassipes** Kunth .... water hyacinth
  free-floating, stoloniferous aquatic; freshwater ponds and waterways

+ **Eleocharis montevidensis** Kunth ....
  rhizomatous perennial; wet sands

+ **Equisetum hyemale** L. .... scouring rush
  rhizomatous perennial; railroad embankments, roadsides and stream banks

+ **Eragrostis minor** Host. ....

+ **Eragrostis reptans** (Michx.) Nees

• **Eupatorium capillifolium** (Lam.) Small . . . . dog-fennel, yankee weed
annual; fields, meadows, pastures, and disturbed woods

\- **Heliotropium curassavicum** L. . . . . seaside heliotrope
annual succulent; seashores and borders of fresh to saline marsh

\- **Hibiscus lasiocarpus** Cav. . . . . marshmallow, woolly rosemallow
perennial; fresh to intermediate marsh on elevated sites

\- **Hydrocotyle bonariensis** Lam. . . . . sand pennywort
perennials; among beach dunes, moist open sandy areas

• - **Iva frutescens** L. . . . . marsh elder
shrub; brackish and saline marshes along elevated sites

\- **Juncus roemerianus** Scheele . . . . needlerush
perennial; upper portions of salt and brackish marshes, often in solid stands

• - **Leptochloa fascicularis** (Lam.) Gray . . . . bearded sprangletop
tufted annual; lakebed, fresh to brackish marsh, best in intermediate marsh subject to drying

\- **Leptochloa panicoides** (presl) Hitchc. . . . . Amazon sprangletop

• **Leptochloa scabra** Nees . . . . sprangletop

• - **Leptochloa uninervia** (Presl) Hitchc & Chase . . . . Mexican sprangletop
tufted annual; waste places

\+ **Lindernia dubia** (L.) Pennell . . . .
annul; savannahs, marshes, alluvial woods and wet ditches

\- **Lippia nodiflora** (L.) Michaux . . . . frogfruit
prostrate perennial herb; sandy open habitats, usually moist

\- **Ludwigia decurrens** Walt. . . . . primrose willow
short-lived perennial; marshes and ditches

• **Ludwigia leptocarpa** (Jacq.) Raven . . . . yellow seedbox
short-lived perennial; marshes and ditches

• - **Ludwigia octovalvis** (Jacq.) Raven . . . . Mexican seedbox
short-lived perennial; marshes and waste places

\+ **Lythrum lineare** L. . . . . loosestrife
herbaceous perennial; brackish marshes

• **Panicum capillare** L. . . . .
tufted annual; fields, roadsides and waste places

• - **Panicum dichotomiflorum** Michx. . . . . fall panicum, zig-zag grass
tufted annual; fresh and intermediate marsh, ditches, low woods

• - **Panicum repens** L. . . . . dogtooth grass, torpedo grass
creeping perennial; fresh and intermediate marsh, slightly elevated sites

\- **Paspalum dissectum** (L.) L. . . . . mudbank paspalum
decumbent annual; fresh to intermediate marsh

• **Paspalum distichum** L. . . . .
mat-froming perennial; brackish and freshwater marshes

• - **Paspalum vaginatum** Sw. . . . . seashore paspalum
rhizomatous perennial; fresh to brackish marsh

• - **Phragmites australis** . . . . roseau cane
tall, rhizomatous, perennial reed; fresh marsh or elevated sites in other marshes

• - **Pluchea odorata** (L.) Cass. . . . . shrubby camphorweed
(P. purpurascens) marsh fleabane
Aromatic annual; salt and brackish marsh, sloughs, swales, salt flats, rarely fresh marshes

\+ **Pluchea purperascens** (Sw.) DC. . . . . camphorweed
aromatic annual; brackish marshes

• - **Polygonum lapathifolium** L. . . . . willow-weed
annual; alluvial fields, river banks, disturbed habitats

• **Portulaca oleracea** L. . . . . common purslane
prostrate annual; fields and waste places, upper beaches, drift areas, edge of brackish marshes

+ **Ptilimnium capillaceum** (Michx.) Raf. . . . . mock bishop's weed
Herbaceous annual; open bottom land, marshes, low pastures and wet roadside ditches

- **Rumex obovatus** Danser. . . . . dock
perennial;

- **Sagittaria latifolia** Willd. . . . . duck potato, Wapato
emersed perennial; fresh marsh, pond edges, swamps,sloughs, ditches

• - **Salicornia bigelovii** Torrey . . . . glasswort
succulent annual; saline marsh, salt flats

- **Salix nigra** Marshall . . . . black willow
shrub or small tree; streambeds and low moist areas

• - **Scirpus americanus** Pers. . . . . American bulrush,
rhizomatous perennial; fresh to intermediate marsh, sandy lake and bayshore freshwater three-square

• **Scirpus olneyi** Gray . . . .
rhizomatous perennial; brackish marshes and ditches

• - **Scirpus robustus** Pursh (S. maritimus) . . . . leafy three-square
perennial; intermediate to saline marsh

+ **Scirpus tabernaemonantani** K.C. Gmel . . . .

• - **Scirpus validus** Vahl . . . . softstem bulrush
creeping perennial; fresh to brackish marsh

• - **Sesbania drummondii** (Rydb) Cory. . . . . yellow rattlebox
(Daubentonia longifolia (Cav.) DC.)
shrub; sandy soils, salt spray community, elevated areas in fresh to saline marsh, scrub pine woods

• **Sesbania exaltata** (Raf.) Cory . . . . red rattlebox
annual; ditches, fields and waste places

+ **Sesuvium maritimum** (Walt.) B.S.P. . . . .
Annual succulent; sandy beaches

• - **Sesuvium portulacastrum** L. . . . . sea purslane
perennial; sandy beaches and flats, drift areas, brackish swales, upper parts of salt marshes

- **Solidago sempervirens** L. . . . . seaside goldenrod
perennial; brackish marsh or saline sand

• **Solidago sp.** . . . . goldenrod
perennial;

• - **Spartina alterniflora** Lorsel . . . . oyster grass
rhizomatous perennial; saline and brackish marsh

• - **Spartina patens** (Aiton) Muhl. . . . . marsh hay cordgrass
rhizomatous perennial; brackish marsh, low dunes, sand flats

- **Sphenoclea zeylandica** Gaertn. . . . . chicken-spike
perennial; weed in rice fields

• - **Strophostyles helvola** (L.) Ell. . . . . trailing wild bean
trailing or twining annual vine; beaches, open woods and clearings

• **Suaeda linearis** (Ell.) Moq. . . . .
annual; moist sand dunes or brackish marshes

+ **Tamarix ramosissima** Lebed. . . . .

- **Typha domingensis** Pers. . . . . southern cattail
rhizomatous perennial; alkaline brackish marsh and swamp

\+ **Verbena bonariensis** L. . . . .
Erect perennial; old fields and waste places

• - **Vigna luteola** (Jacq.) Benth. . . . . deer pea
trailing or twining vine; waste places, elevated areas bordering marshes, low fields

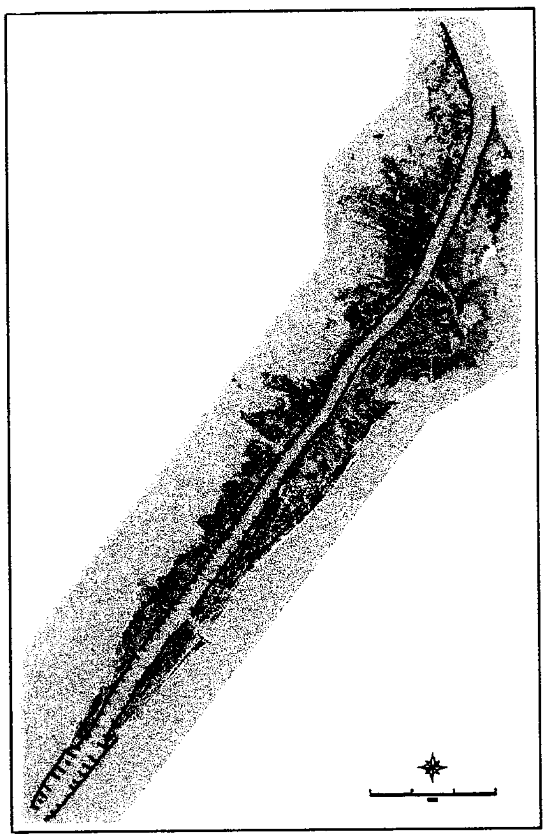
• - **Xanthium strumarium** L. . . . . cocklebur
annual; waste places, old fields, pond shores, ditches, stable dune areas, beaches

U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass

Base Year 1985 thru Fiscal Year 1996



Shea Penland, Karen A. Westphal, Chris Zganjar, Qiang Tao, Jamie Phillippe, and Paul Connor
Coastal Studies Institute - Louisiana State University
Baton Rouge, LA 70803
and

Linda Mathies, Beth Nord, and Fred Schilling
Operations Division - Technical Support Branch (CELMN-OD-T)
U.S. Army Corps of Engineers - New Orleans District
New Orleans, LA 70160-0267

Baton Rouge, Louisiana
1997

TABLE OF CONTENTS

INTRODUCTION 6-1

NAVIGATION AND DREDGING HISTORY 6-3

GIS ANALYSIS RESULTS 6-6
Shoreline Changes: 1985-1996 6-6
Habitat Inventory 6-9
Habitat Change 6-13

CONCLUSIONS 6-17

REFERENCES 6-17

LIST OF FIGURES

Figure 1. Location map of Southwest Pass BUMP study area. 6-2

Figure 2. The Mississippi River - Southwest Pass BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized. 6-4

Figure 3. The dredged material disposal history for the Mississippi River - Southwest Pass BUMP study area, 1985 to 1996. 6-5

Figure 4. Graph of the area of the Mississippi River - Southwest Pass BUMP study area over time, showing the contribution of the beneficial use of dredged material. 6-7

Figure 5. Shoreline changes of the Mississippi River - Southwest Pass BUMP study area between December 1985 and November 1996. 6-8

Figure 6. Habitat inventory map of the Mississippi River - Southwest Pass BUMP study area in December 1985. 6-10

Figure 7. Habitat inventory map of the Mississippi River Gulf Outlet - Jetties BUMP study area in November 1996. 6-12

Figure 8. Map of the Mississippi River - Southwest Pass BUMP study area showing the new habitats created by beneficial use of dredged materials or formed by natural processes between December 1985 and November 1996. 6-14

Figure 9. Time series showing the changes in total area of each habitat in the Mississippi River - Southwest Pass BUMP study area between December 1985 and November 1996. A) natural habitat changes. B) BUMP-made habitat changes. C) Other-made habitat changes. 6-16

LIST OF TABLES

TABLE 1 Mississippi River - Southwest Pass Area: 1985-1996 6-6

TABLE 2 December 1985 Habitat Inventory of the Mississippi River - Southwest Pass BUMP Study Area 6-9

TABLE 3 November 1996 Habitat Inventory of the Mississippi River - Southwest Pass BUMP Study Area 6-11

TABLE 4 Cumulative Change in Total Areas of each Habitat in the Southwest Pass Study Area between 1985 and 1996 6-15

INTRODUCTION

Southwest Pass is the main distributary of the Mississippi River which currently carries the majority of the river's flow and is used for national and international shipping traffic (Figure 1). The Mississippi River drains 1.25 million square miles of the North American continent and flows over 3,900 miles from its headwaters to the Gulf of Mexico. It's sediment load of 300,000,000 tons annually has fashioned much of the state of Louisiana, adding some 15,000 square miles of land in the last 6000 years. The Mississippi River deltaic plain is the third largest in the world. The early appearance of the delta with only three major channels prior to extensive crevasse sedimentation led investigators to refer to the modern river mouth as the *birdfoot* delta (Morgan 1977). The major passes of the modern delta used for navigation include Tiger Pass, Southwest Pass, South Pass, Southeast Pass, Northeast Pass, Pass a Loutre, North Pass, Main Pass, and Baptiste Collete Bayou.

Characteristically only a few channels within a delta system will carry the majority of the flow at any one time. These channels advance slowly seaward, while the remainder of the delta system subsides and deteriorates. Subsidence of the natural levees and interlevee basins by compaction of underlying unconsolidated prodelta clays results in rapid enlargement of ponds and lakes within the subdeltas. Crevasses, or breaks in the levees, divert sediment and can result in extensive land building over varying time periods, forming small splays or large subdeltas.

Artificial modifications of the Mississippi River and its delta have contributed to lower rates of land formation and deltaic deterioration in recent years. Artificial levees and revetments have reduced the occurrence of natural crevasses and their associated land-building processes. Lower rates of land progradation at the mouth of major distributaries is the result of channelization and sediment deposition in deeper waters. Artificially created crevasses and the beneficial use of dredged materials by the U.S. Army Corps of Engineers has imitated the role of natural crevasses in diverting sediment from the channels into shallow water for marsh and other habitat creation.

This is the sixth part of the nine part Beneficial Use of dredged material Monitoring Program (BUMP), 1996 Final Report, representing monitoring results through the USACE-NOD Fiscal Year 1996. The nine parts are:

- Part 1: Introduction and Methodology
- Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
- Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
- Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
- Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
- Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass

Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Canal, Louisiana - Bay Chaland

Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe

Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Using aerial photography LSU classified the natural and man-made habitats in the study area for December 1985 and November 1996 including habitat created during the USACE-NOD FY1996 maintenance event. Through the GIS analysis, the areas of the sites selected were calculated and changes documented. Figure 2 shows the areas of minimum air photo mosaic coverage and the limit of the digitized area.

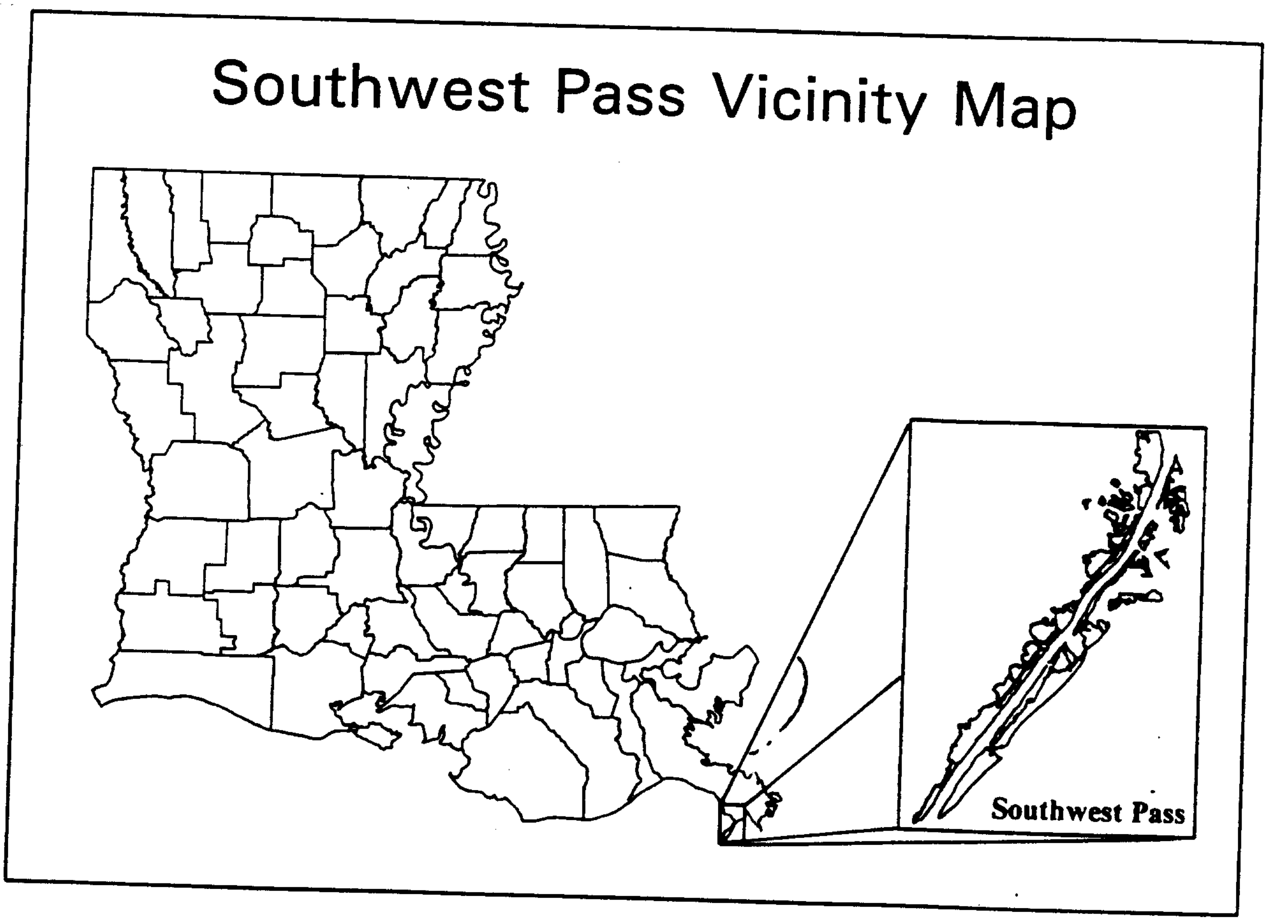


Figure 1. Location map of Southwest Pass BUMP study area.

NAVIGATION AND DREDGING HISTORY

The natural distributaries of the Mississippi River have been used as navigation channels by Europeans since 1682 when La Salle explored the mouth of the river. The site of New Orleans was selected in the early 1700s, and levee construction began as early as 1717 at New Orleans to control flooding. By 1726 a levee 5400 feet long, 18 feet wide and 3 feet high had been constructed. By 1735, levees extended on both sides of the river from 30 miles above New Orleans to 12 miles below, and by 1858 extended to the Ohio River. The effect of the levee system was largely to contain floodwaters within the river channel. Although the levees decreased the number of crevasses that occurred during flood stage of the river, it increased the intensity of the crevasses which did occur, and the modern delta experienced an overall growth in area between 1890s to the mid 1920s.

In 1720, only South Pass of the Mississippi River was utilized for navigation. However, since most commerce came from an easterly direction, a pilot station known as *Balize* was established on an island off of Balize Bayou which was a distributary of Northeast Pass. The Balize settlement was destroyed before 1767 by a flood and the pilot station was moved to the north shore of Northeast Pass. By the late 1700s, Northeast Pass was being surpassed by Pass a Loutre as a main navigation channel, and South Pass had shoaled considerably. Southwest Pass had the greatest water depth over the distributary mouth bar, and by 1813, had become the major channel. Between 1852 and 1869, attempts to increase the depth of the channel at Southwest Pass and Pass a Loutre included jettying, dredging the channel mouth bar, blasting mudlumps, agitation of the bottom with steam-driven propellers, and dragging iron harrows across the bar. None of these techniques were successful and bar deposits soon reformed when attempts ceased. The building of jetties at Southwest Pass commenced in 1902 and was largely completed in 1908, although work on the project continued for nearly another decade, including damming of upstream subsidiary channels (Morgan 1977).

Currently, the USACE-NOD maintains a navigation channel measuring 750 feet in width and 45 feet in depth between mile marker 4.0 above the Head of Passes (AHP) to mile marker 17.5 below the Head of Passes (BHP). Between mile marker 17.5 BHP and mile marker 22.0 BHP the navigation channel measures 600 feet in width and 45 feet in depth. The historical frequency of dredging is annually. Between mile marker 3.5 AHP and mile marker 18.8 BHP the dredged material is beneficially used to create wetlands and for bank nourishment.

Figure 2 shows the limits of the BUMP study site, including the minimum area of coverage of the aerial photography and the area to be digitized. The last maintenance dredging took place in 1996. Figure 3 illustrates the dredged material disposal history for the Southwest Pass study area between 1985 and 1996 based on aerial photographic data.

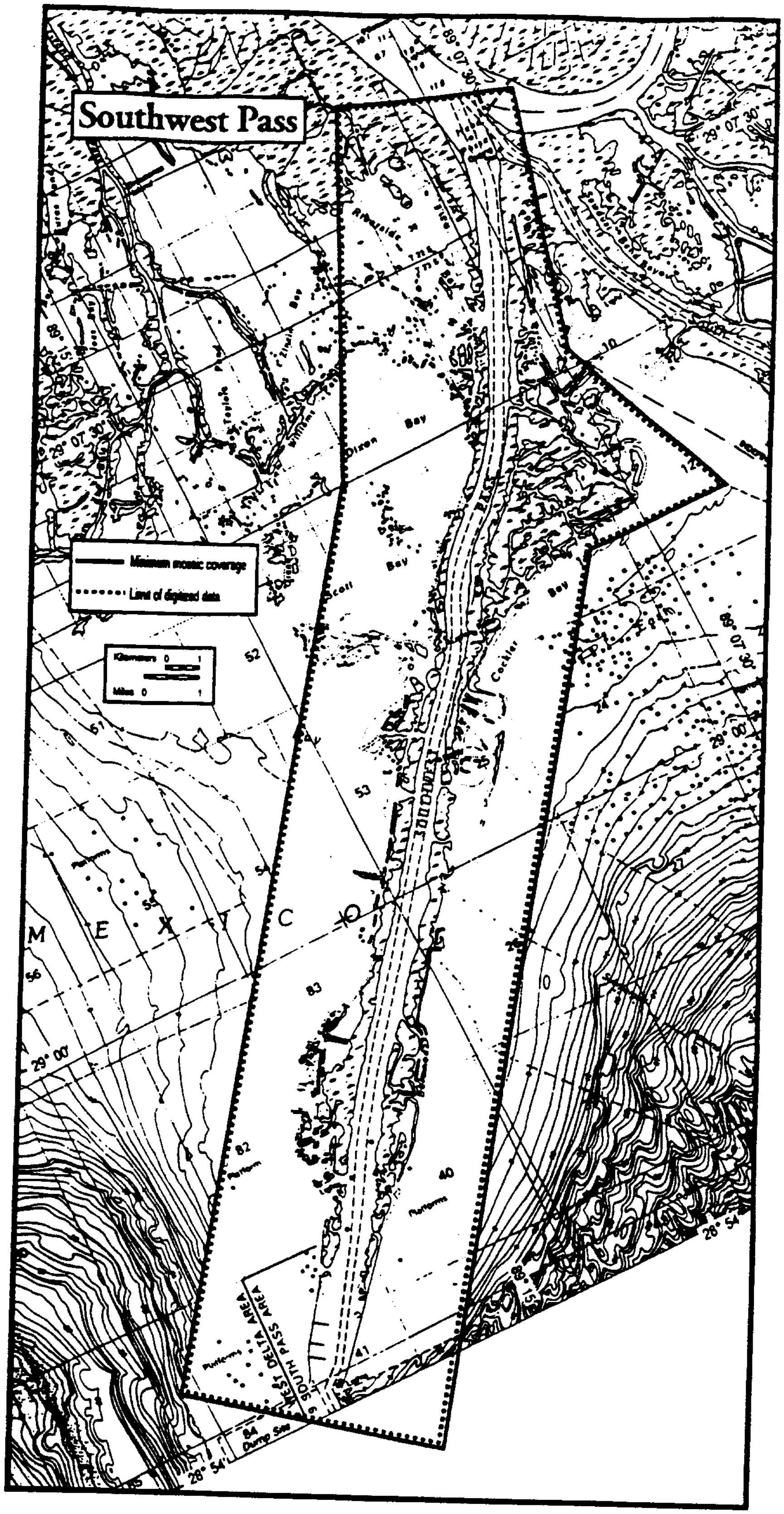


Figure 2. The Mississippi River - Southwest Pass BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized.

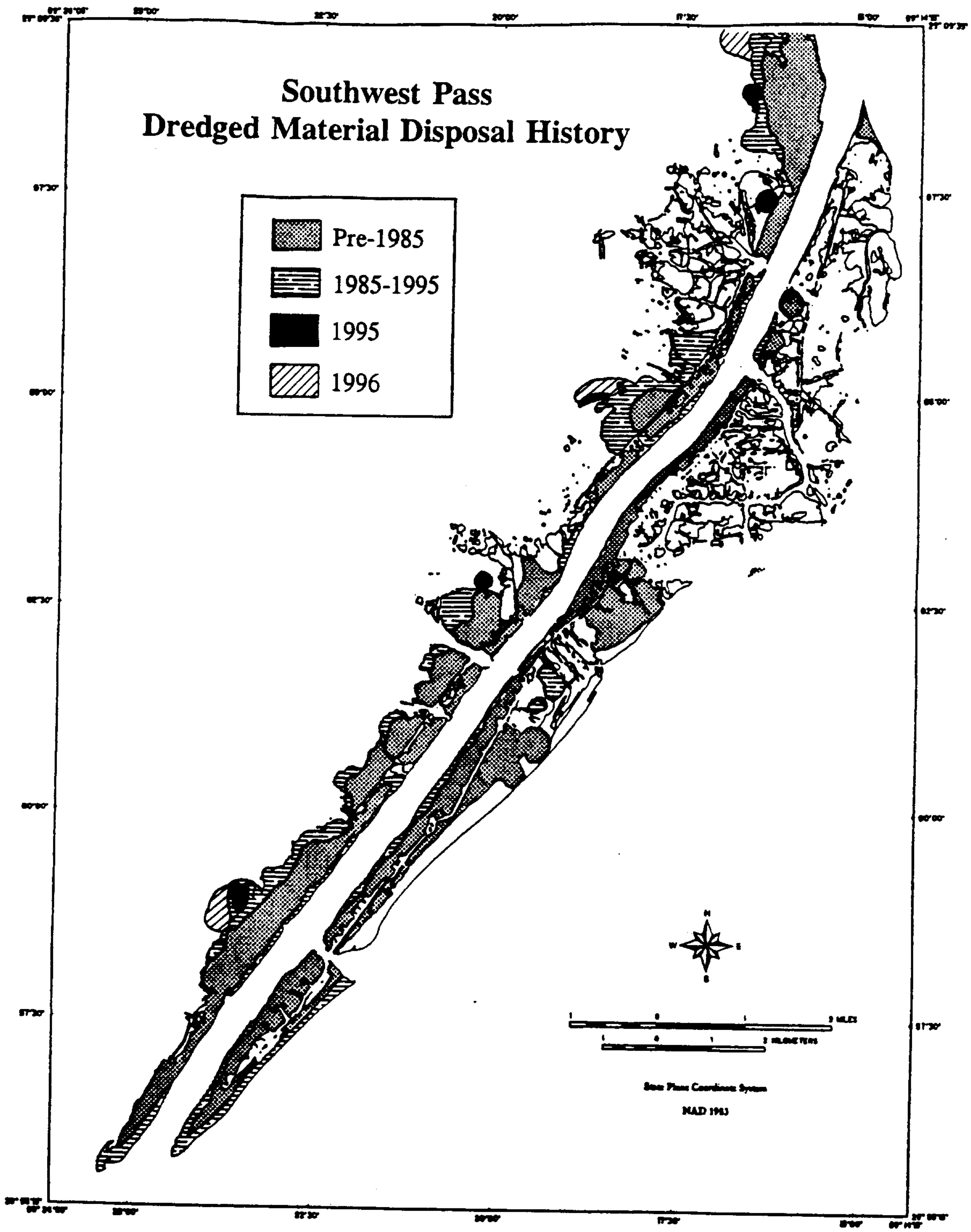


Figure 3. The dredged material disposal history for the Mississippi River - Southwest Pass BUMP study area, 1985 to 1996.

GIS ANALYSIS RESULTS

Shoreline Changes: 1985-1996

Figure 4 graphs the spatial history of the Mississippi River - Southwest Pass BUMP study area between December 1985 and November 1996. Table 1 documents the changes and Figure 5 illustrates the changes that took place at Southwest Pass between 1985 and 1996. In December 1985, the Southwest Pass study area was measured at 9312.9 acres. The study area in November 1996 measured 13,163.3 acres. This is a cumulative area increase of +3850.4 acres at a rate of +350 acres per year. The total area of the Southwest Pass BUMP study site increased by 41 percent between 1985 and 1996. There was an overall increase in the area of Southwest Pass of +882.9 acres in the natural areas. The contribution of BUMP related and other man-made areas accelerated the rate of growth by +2967.5 acres. BUMP-made land totaled +2372.2 acres and other man-made land totaled +2965.5 acres. The BUMP-made habitats accounted for 62 percent of the Southwest Pass Study area between 1985 and 1996.

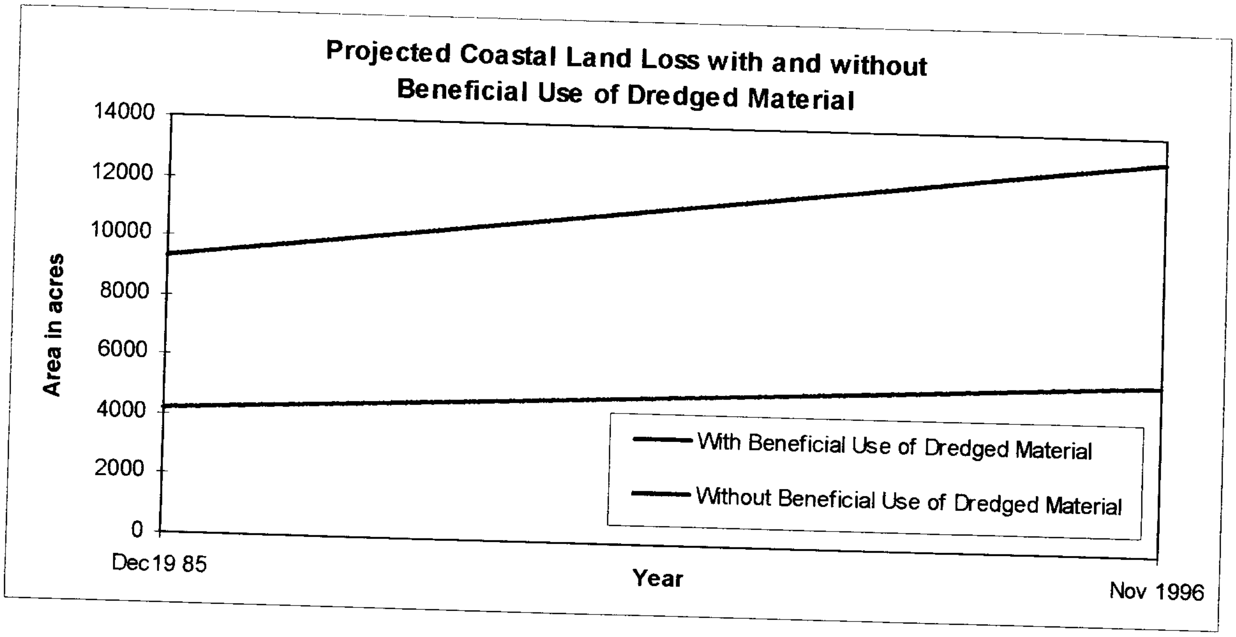
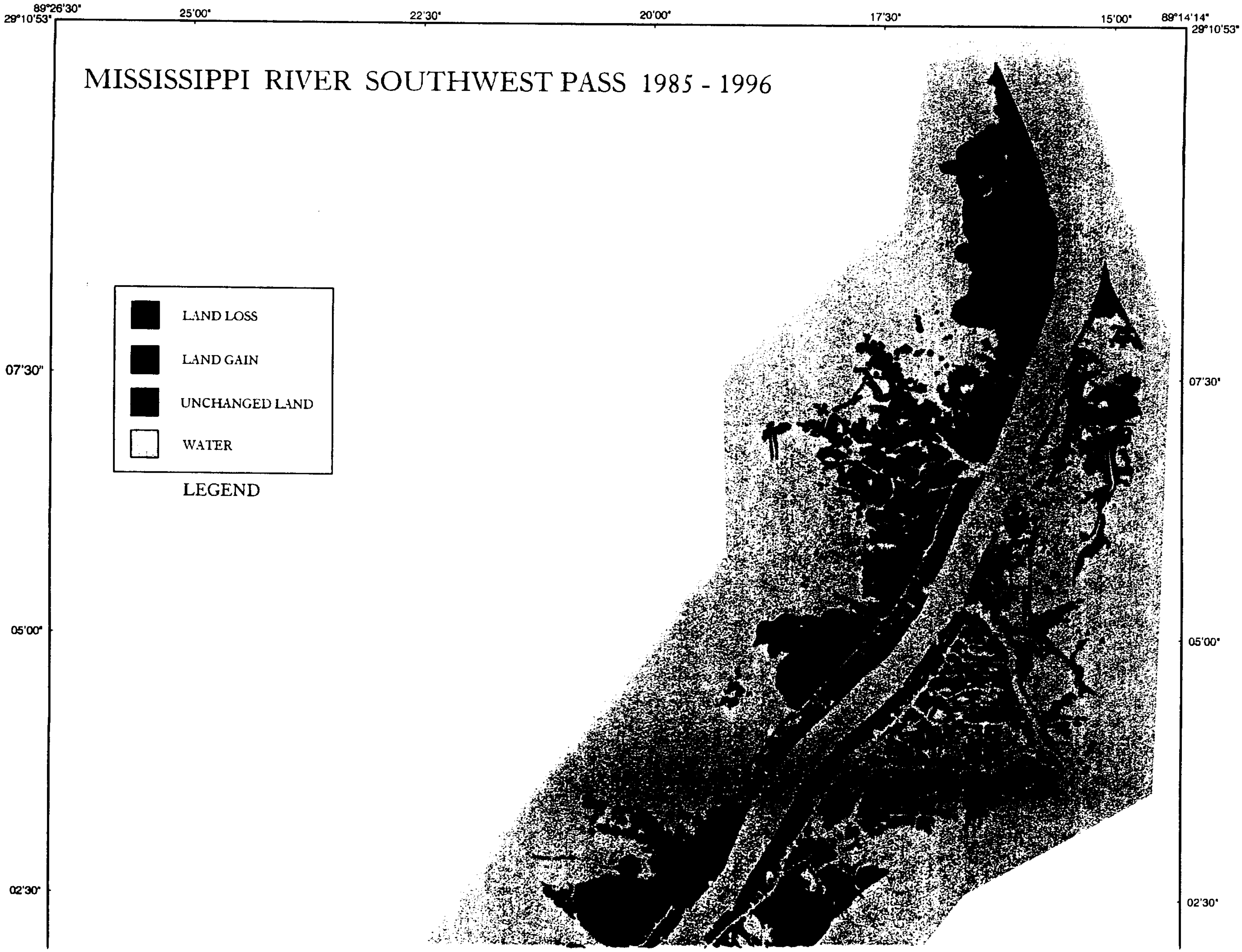


Figure 4. Graph of the area of the Mississippi River - Southwest Pass BUMP study area over time, showing the contribution of the beneficial use of dredged material.

TABLE 1
Mississippi River - Southwest Pass Area: 1985-1996

Area in acres	Dec 1985	Nov 1996	Area Change
Natural Areas	1832.4	2715.3	+882.9
Other Man-made Areas	2370.2	2965.5	+595.5
BUMP-made Areas	5110.3	7482.5	+2372.2
Total	9312.9	13,163.3	+3850.4



MISSISSIPPI RIVER SOUTHWEST PASS 1985 - 1996
89°26'30"
29°10'53"
25'00"
22'30"
20'00"
17'30"
15'00"
89°14'14"
29°10'53"
07'30"
05'00"
02'30"
07'30"
05'00"
02'30"
LAND LOSS
LAND GAIN
UNCHANGED LAND
WATER
LEGEND

1

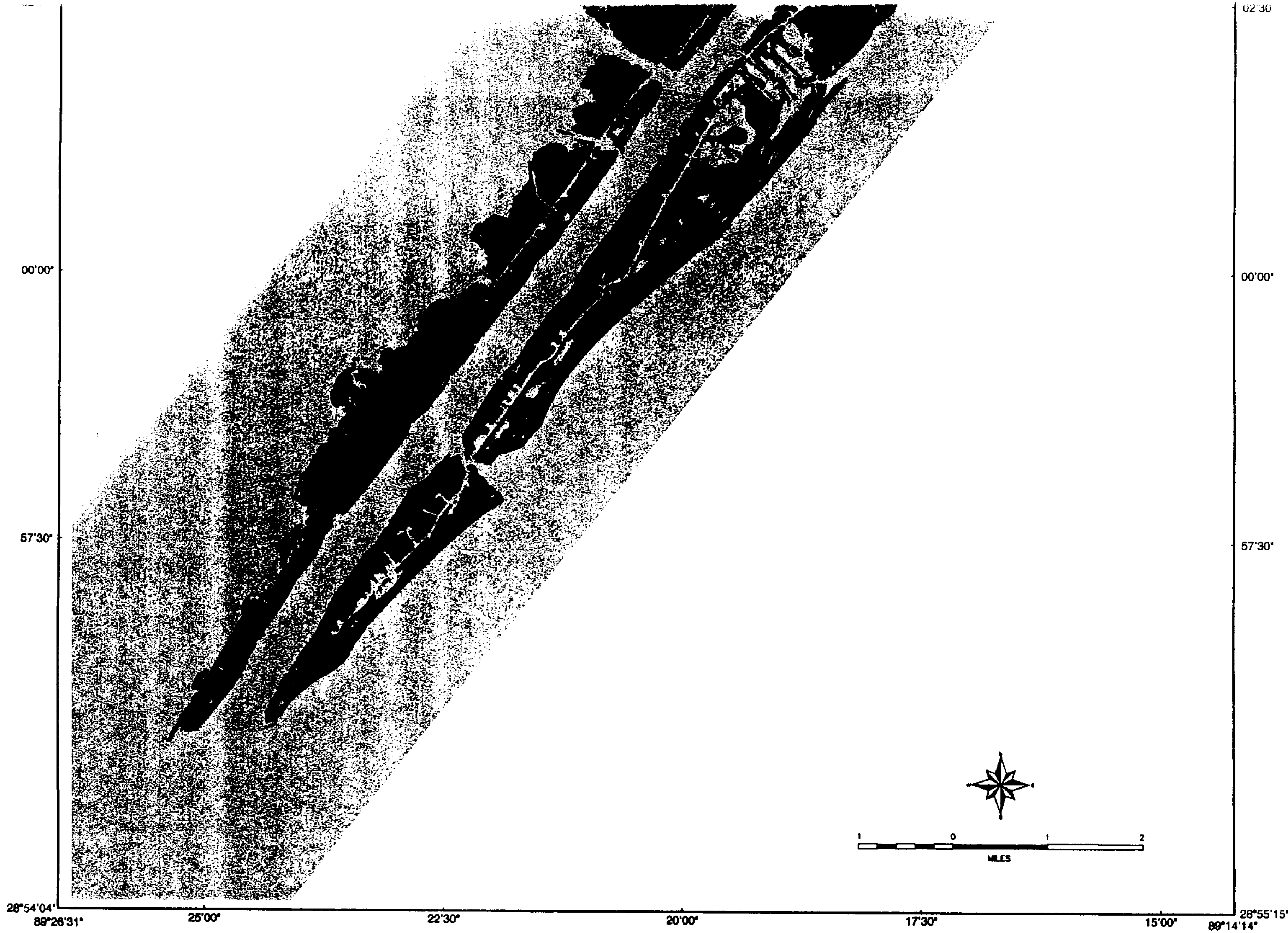


Figure 5. Shoreline changes of the Mississippi River - Southwest Pass BUMP study area between December 1985 and November 1996.

Habitat Inventory

The aerial photographic interpretation combined with field surveys identified six major habitat types in the Mississippi River - Southwest Pass BUMP study area. These habitats are further classified as natural and man-made. The natural class identifies natural deltaic processes as responsible for habitat creation. The BUMP man-made (BUMP-made) class identifies the habitats created by the beneficial-placement of dredged material. The Non-BUMP man-made class (other-made) separates areas created that were not related to the beneficial use of dredged material such as areas created in association with the oil industry access and pipeline canals. On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

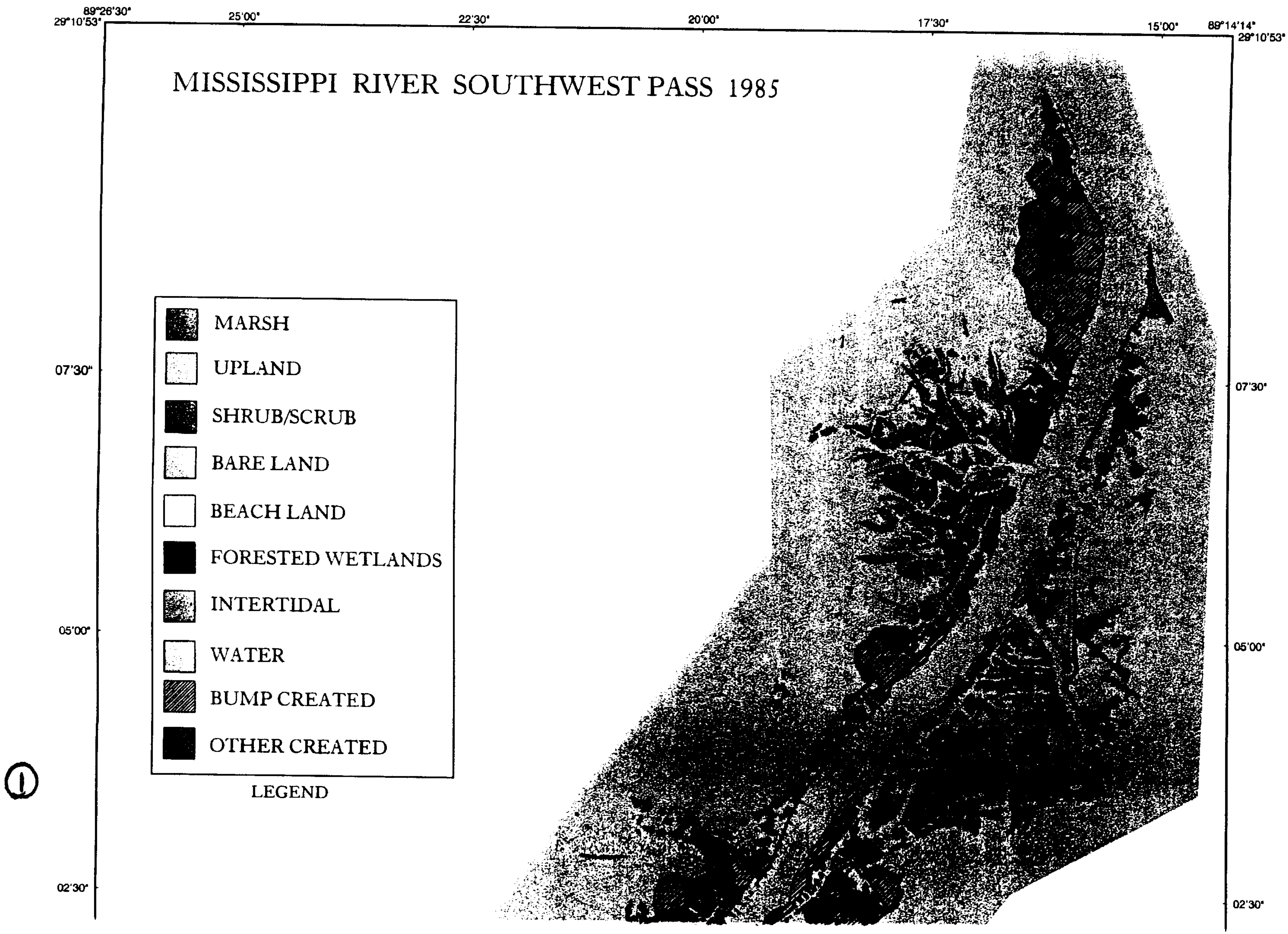
Table 2 lists the areas of the six habitat types found in the Mississippi River - Southwest Pass BUMP study area in December 1985. The location and arrangement of these habitats is presented in figure 6. The total area of the Southwest Pass study site was 9,312.9 acres. Of this total, 1832.4 acres were natural and 7,480.5 acres were man-made including 5,110.3 acres of BUMP-made and 2,370.2 acres of other-made, or 19.7 percent were natural, 54.9 percent were BUMP-made and 25.5 percent were other-made.

In order of decreasing size and importance, the largest habitats found were BUMP-made marsh (2,197.4 acres) followed by other-made marsh (1,670.5 acres), BUMP-made upland (1,606.1 acres), and natural marsh (1,511.2 acres).

In terms of habitat totals, marsh (5,379.1 acres or 57.8%) dominated the Mississippi River - Southwest Pass landscape.

TABLE 2
December 1985 Habitat Inventory of the Mississippi River - Southwest Pass BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	5379.1	1511.2	1670.5	2197.4
Upland	1809.8	61.3	142.4	1606.1
Shrub/Scrub	379.3	3.7	345.1	30.5
Forest	116.8	21.5	69.5	25.8
Bare Land	1382.5	5.7	142.7	1234.1
Beach	245.4	229.0	0.0	16.4
Habitat Total	9312.9	1832.4	2370.2	5110.3


MISSISSIPPI RIVER SOUTHWEST PASS 1985
89°26'30"
29°10'53"
25'00"
22'30"
20'00"
17'30"
15'00"
89°14'14"
29°10'53"
07'30"
05'00"
02'30"
07'30"
05'00"
02'30"
MARSH
UPLAND
SHRUB/SCRUB
BARE LAND
BEACH LAND
FORESTED WETLANDS
INTERTIDAL
WATER
BUMP CREATED
OTHER CREATED
LEGEND
1

②

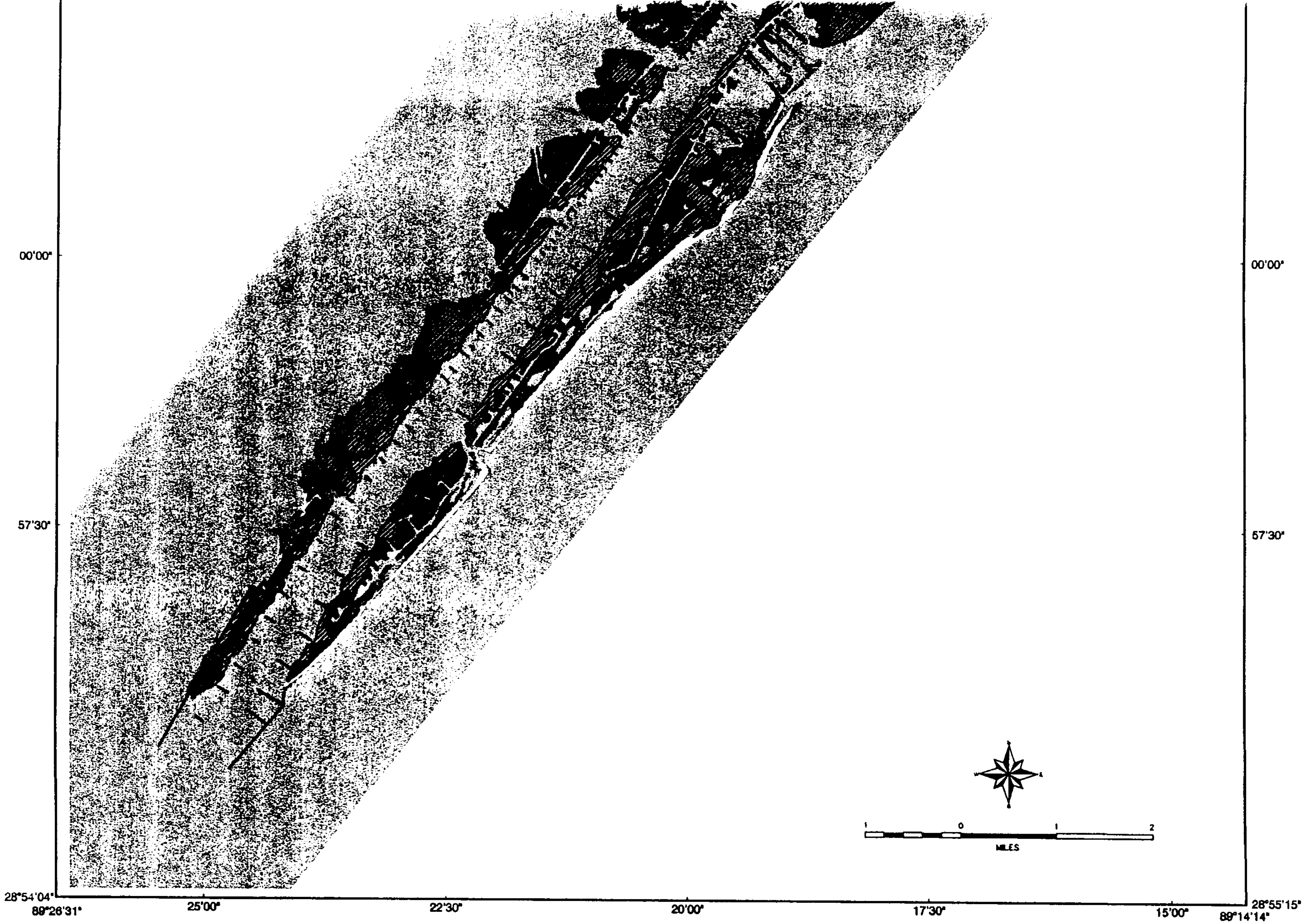


Figure 6. Habitat inventory map of the Mississippi River - Southwest Pass BUMP study area in December 1985.

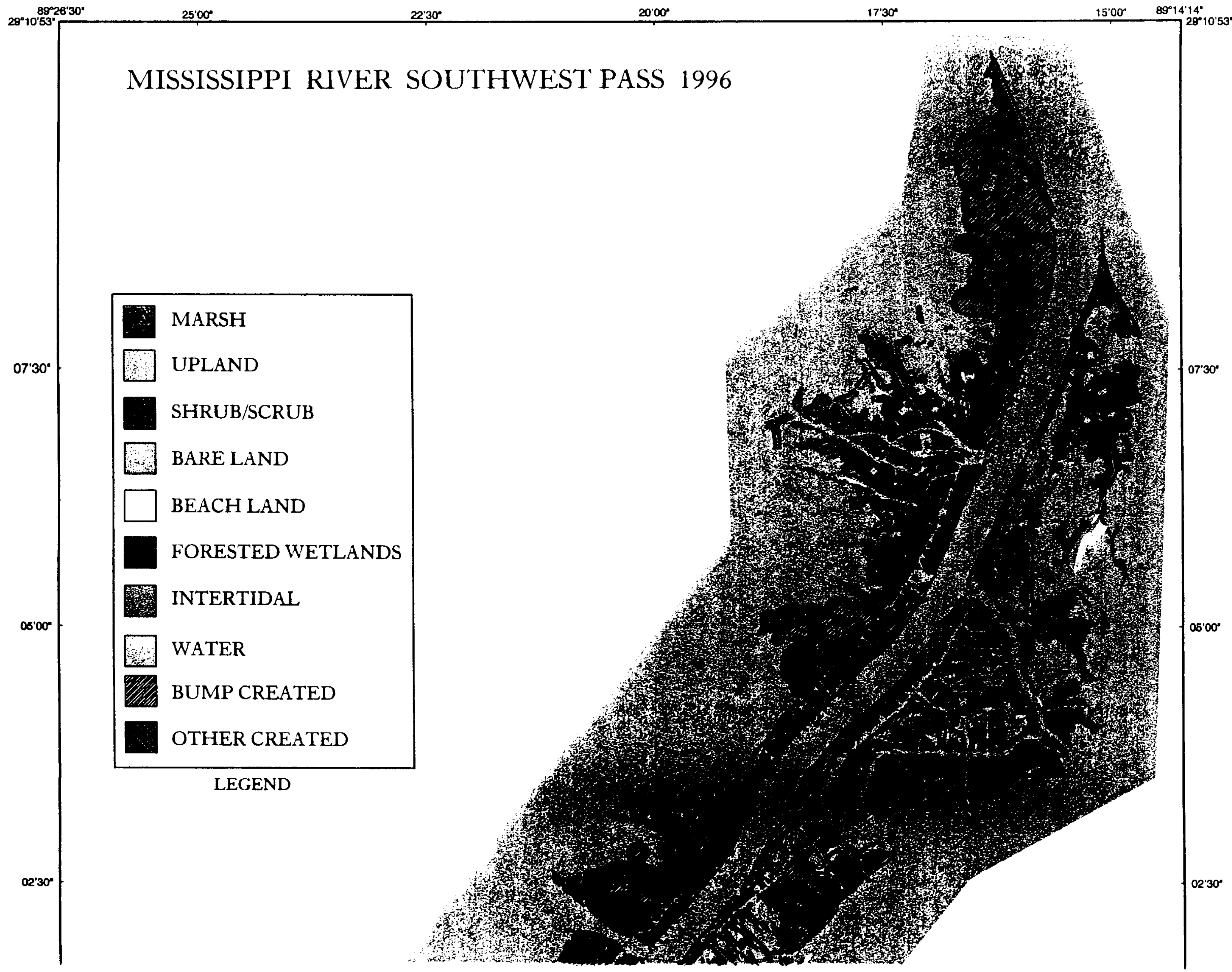
Table 3 lists the areas of the six habitats found in the Mississippi River - Southwest Pass BUMP study area in November 1996. The location and arrangement of these habitats is presented in figure 7. In 1996, the total area of the Mississippi River - Southwest Pass BUMP study area was calculated at 13,163.3 acres. Of this total, 2715.3 acres were natural and 10,448.0 acres were man-made including 7,482.5 acres BUMP-made and 2.965.5 acres other-made, or 20.6 percent was natural, 56.8 percent was BUMP-made and 22.5 percent was other-made.

In order of decreasing size and importance, the largest habitats found were BUMP-made marsh (3537.3 acres) followed by natural marsh (2313.6 acres), BUMP-made upland (1796.2 acres), and other-made marsh (1719.1 acres).

In terms of total area, marsh (7570.0 acres or 57.5%) dominated the landscape of the Mississippi River - Southwest Pass BUMP study area.

TABLE 3
November 1996 Habitat Inventory of the
Mississippi River - Southwest Pass BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	7570.0	2313.6	1719.1	3537.3
Upland	2171.7	203.0	172.5	1796.2
Shrub/Scrub	1982.3	31.6	508.6	1442.1
Forest	483.7	1.4	439.6	42.7
Bare Land	745.7	4.4	119.3	622.0
Beach	209.9	161.3	6.4	42.2
Habitat Total	13163.9	2715.3	2965.5	7482.5


MISSISSIPPI RIVER SOUTHWEST PASS 1996
MARSH
UPLAND
SHRUB/SCRUB
BARE LAND
BEACH LAND
FORESTED WETLANDS
INTERTIDAL
WATER
BUMP CREATED
OTHER CREATED
LEGEND
89°26'30"
29°10'53"
25'00"
22'30"
20'00"
17'30"
15'00"
89°14'14"
29°10'53"
07'30"
05'00"
02'30"

1

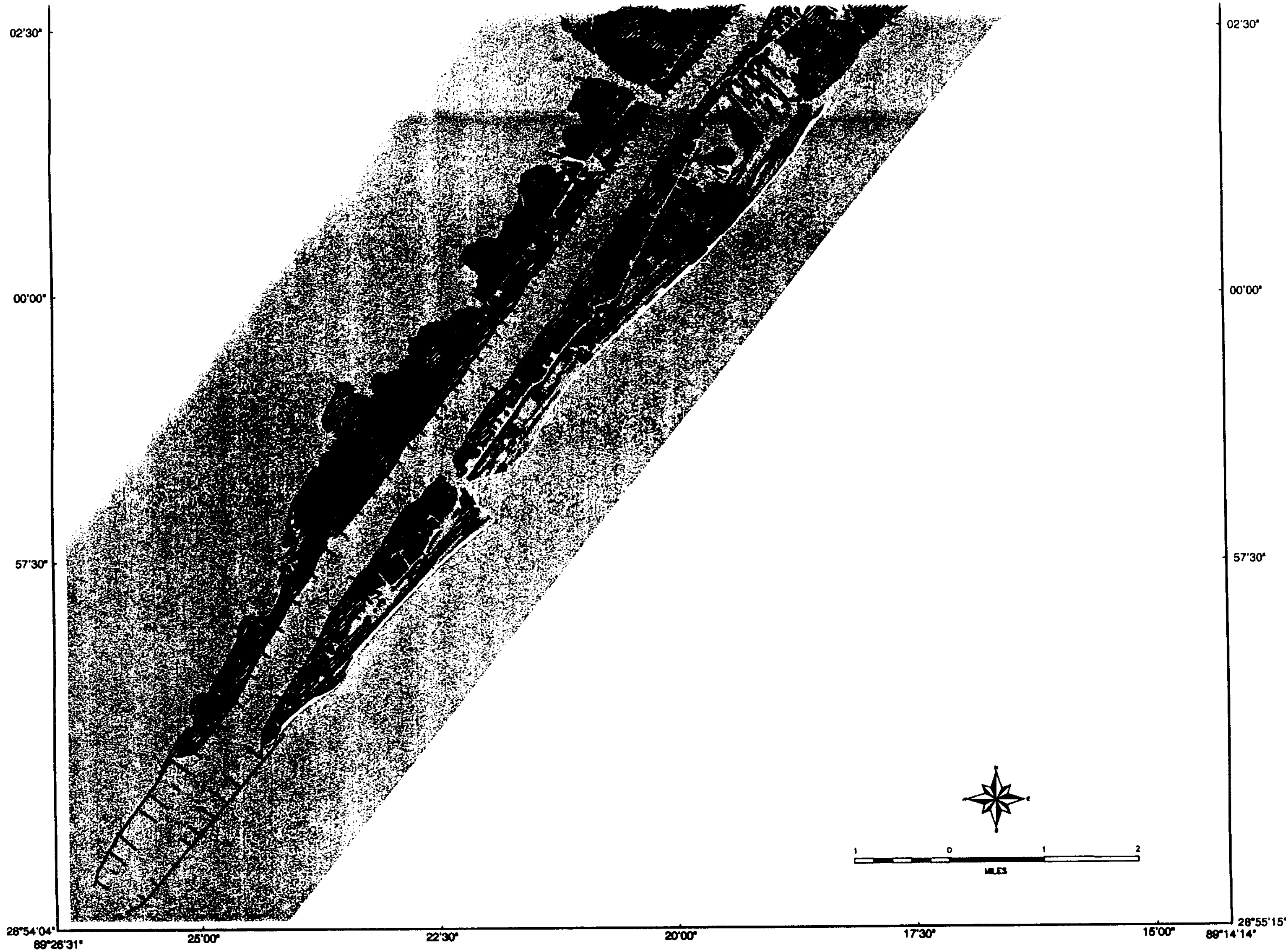


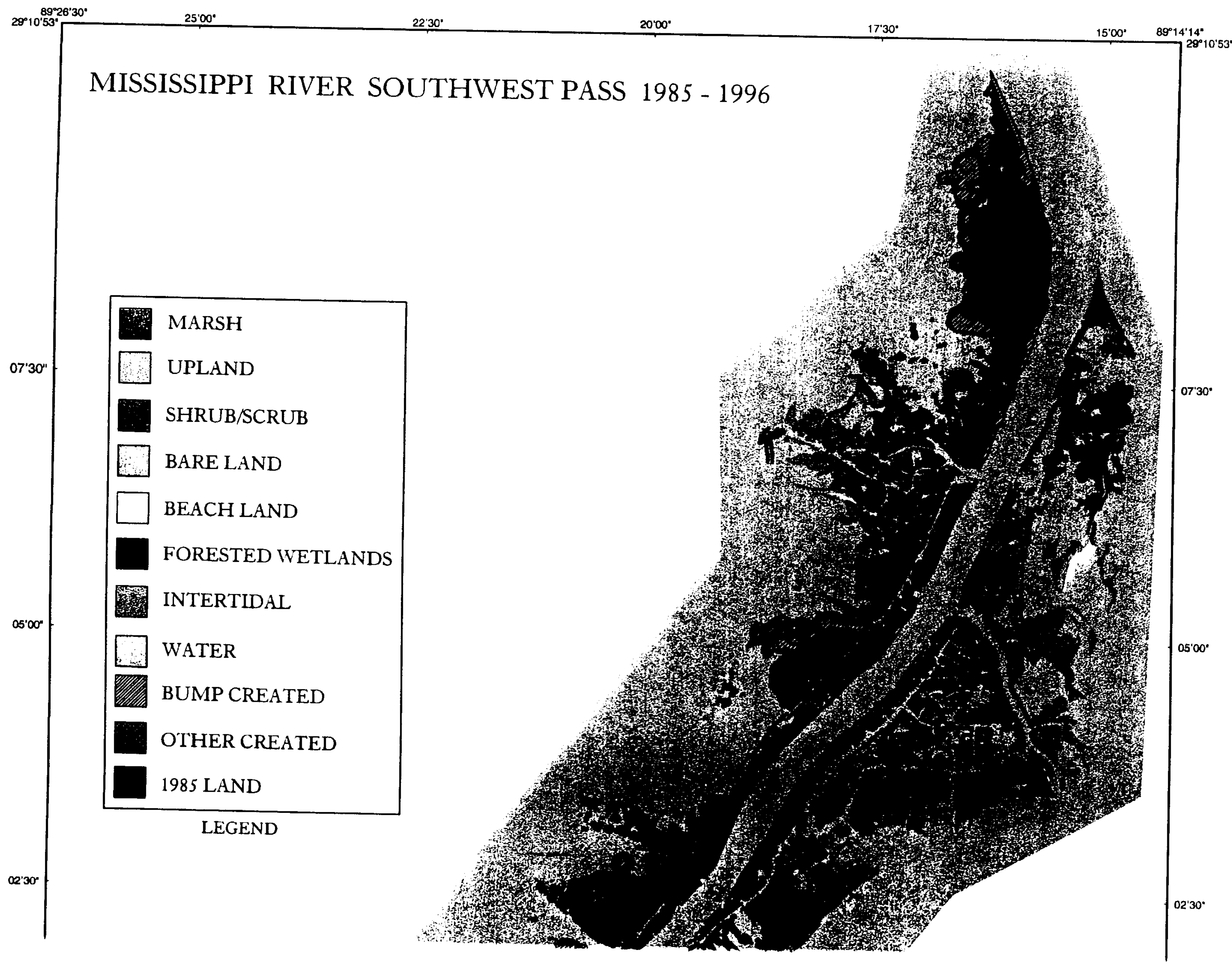
Figure 7. Habitat inventory map of the Mississippi River - Southwest Pass BUMP study area in November 1996.

Habitat Change

Figure 8 shows the creation of new habitat, both natural and man-made, along the Mississippi River - Southwest Pass BUMP study area by comparing December 1985 and November 1996. Land gain due to beneficial use of dredged materials dominates the processes of this area. The total area increased by +3850.4 acres which represents a +41percent increase in area between 1985 and 1996. There was an overall increase of +882.8 acres of the natural habitats, an increase of +595.3 acres in other-made habitats, and an increase of +2372.2 acres of BUMP-made habitats. Table 4 lists the major habitat changes during the period between December 1985 and November 1996.

The greatest cumulative habitat changes between 1985 and 1996 were the increase of BUMP-made scrub/shrub (+1411.6 acres) and BUMP-made marsh (+1339.9 acres). For the natural areas, there was a gain of +802.4 acres of marsh and +141.7 acres of upland. The natural shrub/scrub class increased by +27.9 acres. The overall change in natural and man-made habitats was an increase of +3850.4 acres.

Figure 9 shows a time series of habitat changes along the Mississippi River - Southwest Pass BUMP study area. 9A graphs the natural habitat changes over time. Natural land building and erosion dominates the processes effecting the natural habitat class. 9B graphs the man-made habitat changes over time. Marsh and shrub/scrub creation by beneficial use of dredged material dominates the man-made class.


MISSISSIPPI RIVER SOUTHWEST PASS 1985 - 1996
89°26'30"
29°10'53"
25'00"
22'30"
20'00"
17'30"
15'00"
89°14'14"
29°10'53"
07'30"
05'00"
02'30"
MARSH
UPLAND
SHRUB/SCRUB
BARE LAND
BEACH LAND
FORESTED WETLANDS
INTERTIDAL
WATER
BUMP CREATED
OTHER CREATED
1985 LAND
LEGEND

1

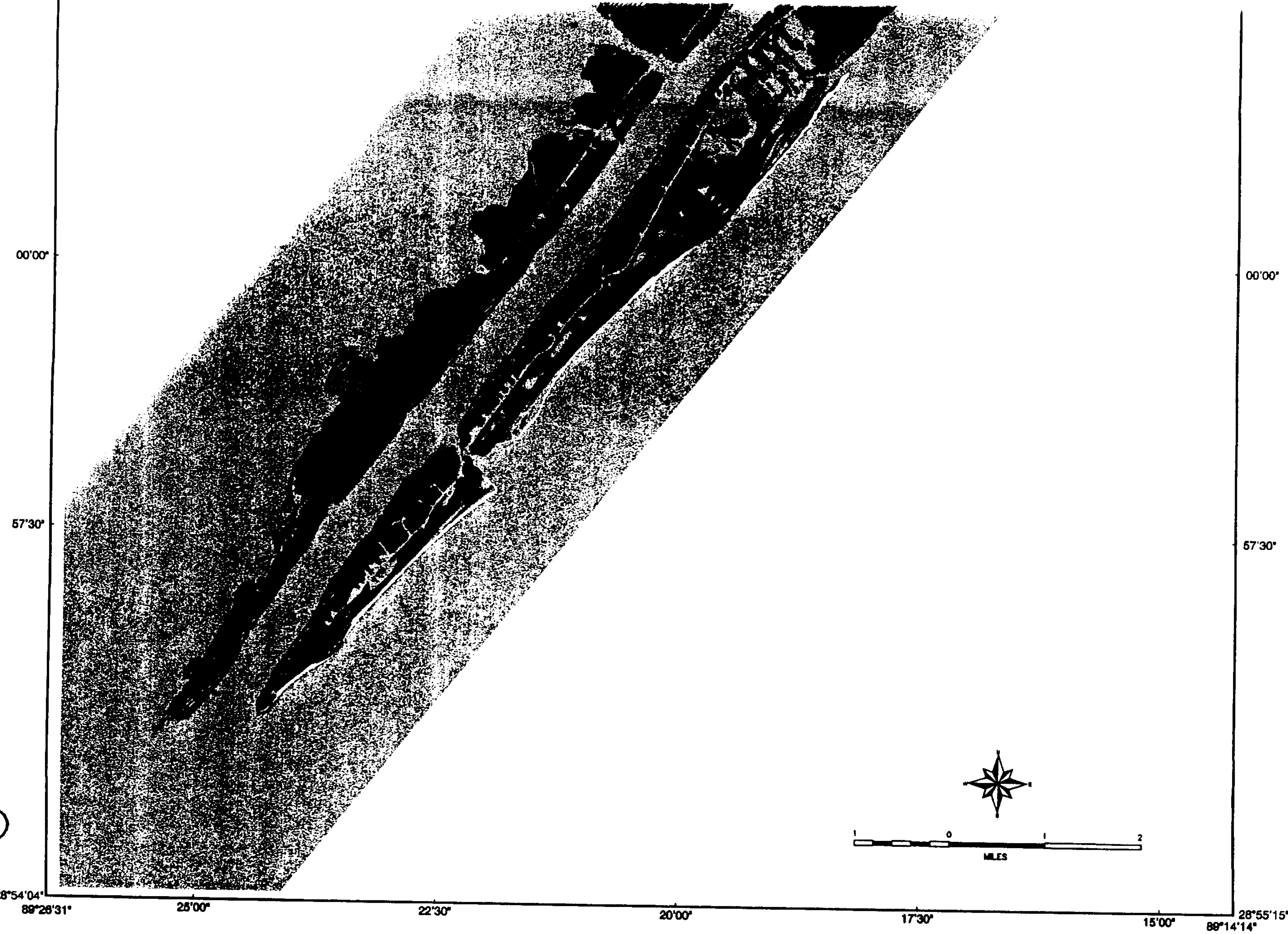


Figure 8. Map of the Mississippi River - Southwest Pass BUMP study area showing the new habitats created by beneficial use of dredged materials or formed by natural processes between December 1985 and November 1996.

②

TABLE 4
Cumulative Change in Total Areas of each Habitat in the Southwest Pass Study Area between 1985 and 1996[1]

HABITAT	Dec 1985	Nov 1996	AREA CHANGE
Natural Marsh	1511.2	2313.6	+802.4
Natural Upland	61.3	203.0	+141.7
Natural Shrub/Scrub	3.7	31.6	+27.9
Natural Forest	21.5	1.4	-20.1
Natural Bare Land	5.7	4.4	-1.3
Natural Beach	229.0	161.3	-67.7
Total Natural Habitats	1832.4	2715.3	+882.9
Other Man-made Marsh	2197.4	3537.3	+1339.9
Other Man-made Upland	1606.1	1796.2	+190.1
Other Man-made Shrub/Scrub	30.5	1442.1	+1411.6
Other Man-made Forest	25.8	42.7	+16.9
Other Man-made Bare Land	1234.1	622.0	-612.1
Other Man-made Beach	16.4	42.2	+25.8
Total Other Man-made Habitats	5110.3	7482.5	+2372.2
BUMP-made Marsh	1670.5	1719.1	+48.6
BUMP-made Upland	142.4	172.5	+30.1
BUMP-made Shrub/scrub	345.1	508.6	+163.5
BUMP-made Forest	69.5	439.6	+370.1
BUMP-made Bare Land	142.7	119.3	-23.4
BUMP-made Beach	0.0	6.4	+0.4
Total BUMP-made Habitats	2370.2	2965.5	+595.3
HABITAT TOTAL	9312.9	13163.3	+3850.4

[1] in acres

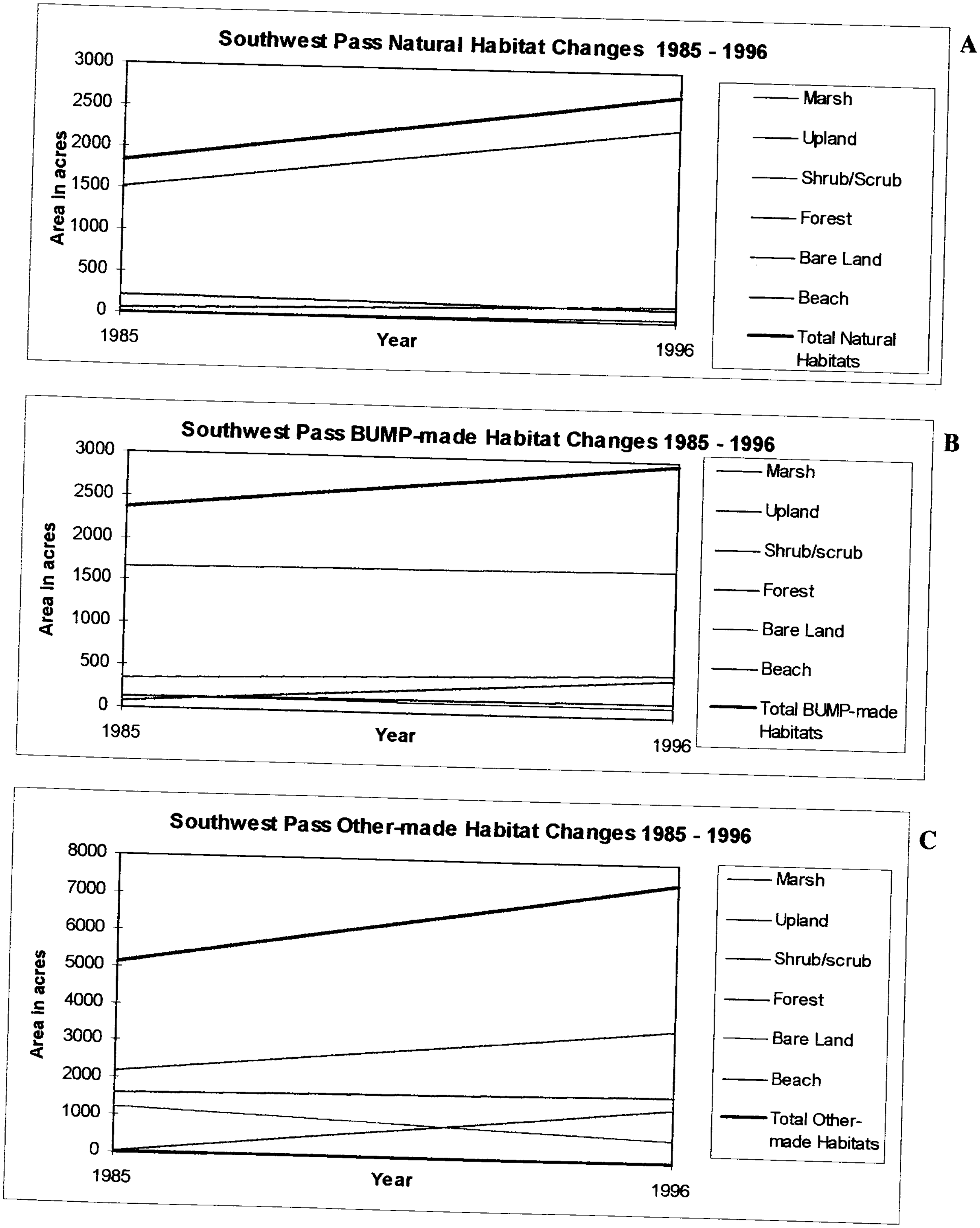


Figure 9. Time series showing the changes in total area of each habitat in the Mississippi River - Southwest Pass BUMP study area between December 1985 and November 1996. A) natural habitat changes. B) BUMP-made habitat changes. C) Other-made habitat changes.

CONCLUSIONS

1. The beneficial use of dredged material at the Southwest navigation channel has been very successful in creating new habitats and has accelerated the growth of this Mississippi River distributary between 1985 and 1996.

2. The beneficial use of dredged material has created +2372.2 acres of man-made habitats between 1985 and 1996. Other man-made habitat creation account for an increase of +2372 acres. Currently, the natural habitats in the study area have slowly increased by +882.9 acres. The total rapid increase in area of Southwest Pass is a result of natural processes accelerated by wetland and other habitat creation as a result of the benefical use of dredged material.

3. The habitat inventory documented that the study area is primarily dominated by man-made habitats. In 1985, the study area contained 9312.9 acres of which 20% was natural and 80% was man-made. In 1996, the study area contained 13,163.3 acres of which 20% remained natural and 80% remained man-made.

4. The habitat change analysis indicated that +1339.9 acres of BUMP-made marsh was created throught the beneficial use of dredged material. Other significant habitat increases include +1411.6 acres of BUMP-made shrub/scrub and +190.1 acres of BUMP-made upland.

REFERENCES

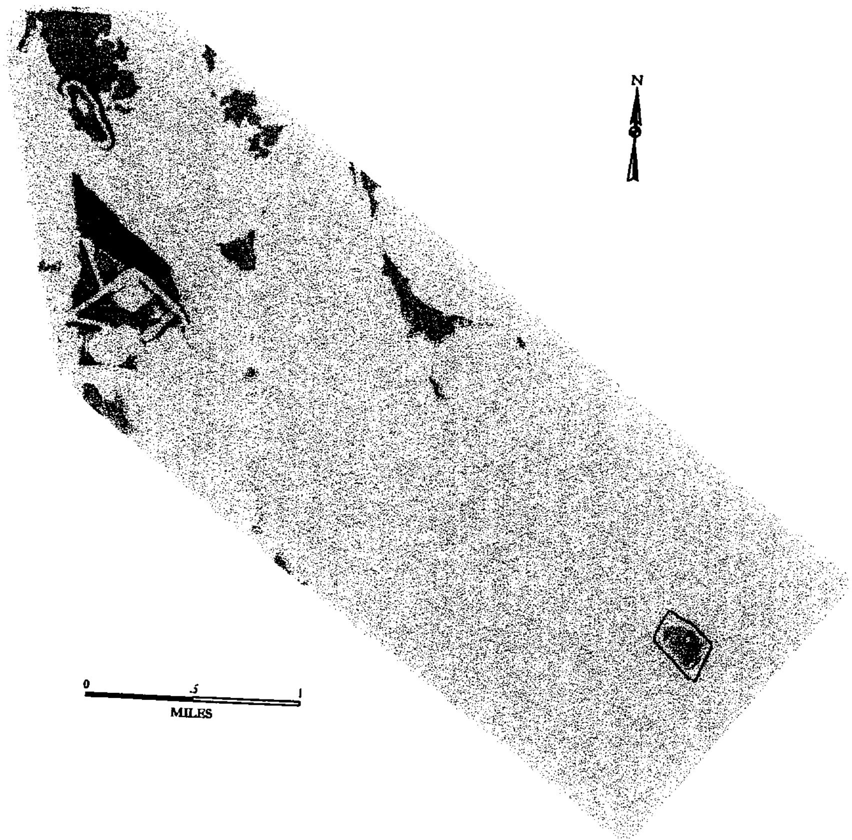
Morgan, Joel David, 1977. The Mississippi River Delta - Legal-Geomorphic evaluation of historic shoreline changes in *Geoscience and Man*, Vol. 15, School of Geoscience, Louisiana State University, Baton Rouge, Louisiana.

U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Canal, Louisiana - Bay Chaland

Base Year 1990 through Fiscal Year 1996



Shea Penland, Karen A. Westphal, Qiang Tao, Chris Zganjar, and Paul Connor
Louisiana State University - Coastal Studies Institute
Baton Rouge, LA 70803

and

Linda Mathies, Beth Nord, and Robert Gunn
Operations Division - Technical Support Branch (CELMN-OD-T)
U.S. Army Corps of Engineers - New Orleans District
New Orleans, LA 70160-0267

Baton Rouge, Louisiana
1997

TABLE OF CONTENTS

INTRODUCTION 7-1

DREDGED MATERIAL DISPOSAL HISTORY 7-5

FIELD SURVEY RESULTS 7-6
Methodology 7-6
Elevation Profile Surveys 7-6
Vegetation Surveys 7-8
Profiles 7-8
Vegetative Character 7-12
General Description 7-12
Vegetative community types 7-12

GIS ANALYSIS RESULTS 7-13
Shoreline Changes: 1990-1996 7-13
Habitat Inventory 7-16
Habitat Change 7-24

CONCLUSIONS 7-27

APPENDIX 7A 7A-1

LIST OF FIGURES

Figure 1. The location of the Houma Navigation Canal, Louisiana - Bay Chaland BUMP study site in Louisiana. . . . 7-1

Figure 2a. The upper reach of the Houma Navigation Canal - Bay Chaland BUMP study area showing the minimum coverage of the aerial photo-mosaic. . . . 7-3

Figure 2b. The lower reach of the Houma Navigation Canal - Bay Chaland BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized. . . . 7-4

Figure 3. The dredged material disposal history for the Houma Navigation Canal- Bay Chaland study area. . . . 7-5

Figure 4. Location of the Houma Navigation Canal - Bay Chaland BUMP study area transects and the tide gage that was used to reference the elevation data. . . . 7-7

Figure 5. Photograph of the Houma Navigation Canal - Bay Chaland Mile 11.3 BUMP study site in September 1996. This view is from the channel side dike, looking across the shallow lagoon to the semi-confined saltmarsh. . . . 7-9

Figure 6. Elevation profile of Bay Chaland Mile 11.3 BUMP study site with vegetation data illustrated. . . . 7-9

Figure 7. Photograph of the Houma Navigation Canal Mile 7.1-8.0 BUMP study site taken in September 1996, showing the rock dike that partially encloses the existing natural marsh. . . . 7-10

Figure 8. Photograph of the Houma Navigation Canal Mile 7.1-8.0 BUMP study site taken in September 1996, showing the transect line that is in line with survey markers left by a previous crew. . . . 7-11

Figure 9. Elevation profile of the Houma Navigation Canal Mile 7.1-8.0 BUMP study site with vegetation data illustrated. . . . 7-11

Figure 10. Graph of the area of the Houma Navigation Canal - Bay Chaland BUMP study area over time. The green line graphs the total natural area excluding areas created by beneficial use of dredged materials and other man-made areas . . . 7-14

Figure 11. Shoreline change history for the Houma Navigation Canal - Bay Chaland BUMP study area between December 1990 and November 1996. . . . 7-15

Figure 12. Habitat inventory map of the Houma Navigation Canal - Bay Chaland BUMP study area in December 1990. 7-17

Figure 13. Habitat inventory map of the Houma Navigation Canal - Bay Chaland BUMP study area in February 1995. 7-19

Figure 14. Habitat inventory map of the Houma Navigation Canal - Bay Chaland BUMP study area in October 1995. 7-21

Figure 15. Habitat inventory map of the Houma Navigation Canal - Bay Chaland BUMP study area in November 1996. 7-23

Figure 16. Time series showing the changes in total area of each habitat in the Houma Navigation Canal BUMP study area between December 1990 and November 1996. A) natural habitat changes. B) Man-made habitat changes. 7-26

LIST OF TABLES

TABLE 1. Houma Navigation Canal - Bay Chaland Area: 1990-1996 7-14

TABLE 2. December 1990 Habitat Inventory of the Houma - Bay Chaland BUMP Study Area 7-16

TABLE 3. February 1995 Habitat Inventory of the Houma - Bay Chaland Study Area . . 7-18

TABLE 4. October 1995 Habitat Inventory of the Houma - Bay Chaland BUMP Study Area 7-20

TABLE 5. November 1996 Habitat Inventory of the Houma - Bay Chaland BUMP Study Area 7-22

TABLE 6. Houma Navigation Canal - Bay Chaland Cumulative Change in Total Acres of each Habitat Between December 1990, February 1995, October 1995, and 1996 7-25

INTRODUCTION

The Houma Navigation Canal, Louisiana - Bay Chaland BUMP study area is located in Terrebonne Parish in south-central Louisiana (Figure 1). The navigation channel runs north to south and extends approximately 36 miles from Houma into Lake Pelto and then between Wine Island and Timbalier Island through Cat Island Pass into the Gulf of Mexico. The U.S. Army Corps of Engineers - New Orleans District (USACE-NOD) maintains the channel by dredging every two years with a cutterhead dredge. Approximately 100,000 to 400,000 cubic yards of sediment is dredged and the dredged material is used in semi-confined and unconfined beneficial use areas for wetland development.

The Beneficial Use of dredged material Monitoring Program (BUMP) at Louisiana State University - Coastal Studies Institute (LSU-CSI) is documenting the beneficial use of dredged material using aerial photography, geographical information system (GIS) analysis, and field surveys through the sponsorship of the USACE-NOD. This report includes data for the USACE-NOD Fiscal Year (FY)1990 through FY96 maintenance events. BUMP results are provided in map series, annual reports, and scientific literature.

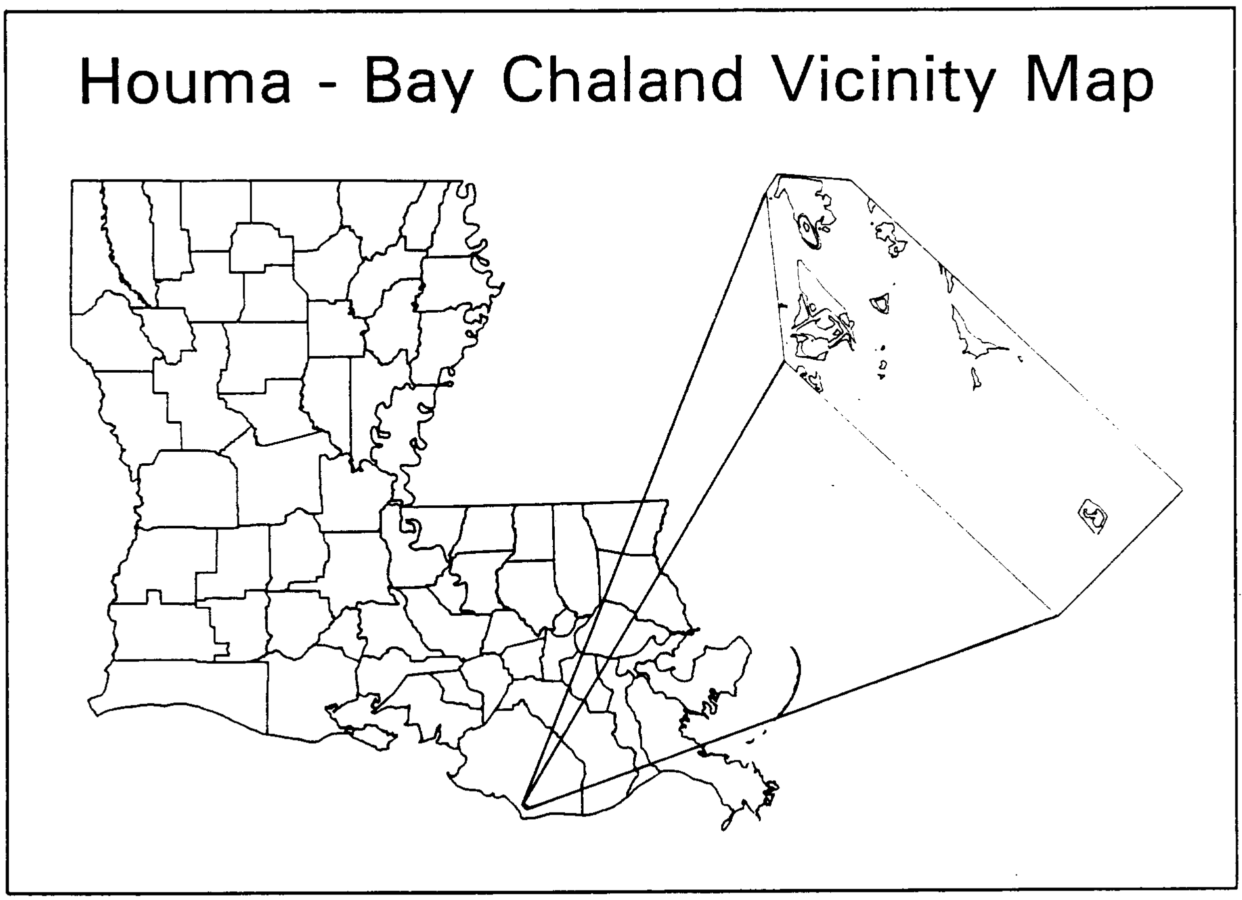


Figure 1. The location of the Houma Navigation Canal, Louisiana - Bay Chaland BUMP study site in Louisiana.

This is the seventh part of the nine part Beneficial Use of dredged material Monitoring Program (BUMP), Final Report, representing monitoring results through the USACE-NOD Fiscal Year 1996. The nine parts are:

- Part 1: Introduction and Methodology
- Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
- Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
- Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
- Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
- Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass
- Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Canal, Louisiana - Bay Chaland
- Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe
- Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Using aerial photography, LSU classified the natural and man-made habitats in the study area for December 1990, February/April 1995, November 1995, and November 1996. Through GIS analysis, these areas were calculated and changes documented. Field surveys were conducted in September 1996 on the beneficial use areas created in 1993 and 1995. Habitats were ground truthed and survey transects established to document vegetation species, stacking elevations, and as a base for measuring compaction. Figure 2 shows the area of minimum aerial photo-mosaic coverage and the limit of the digitized area.

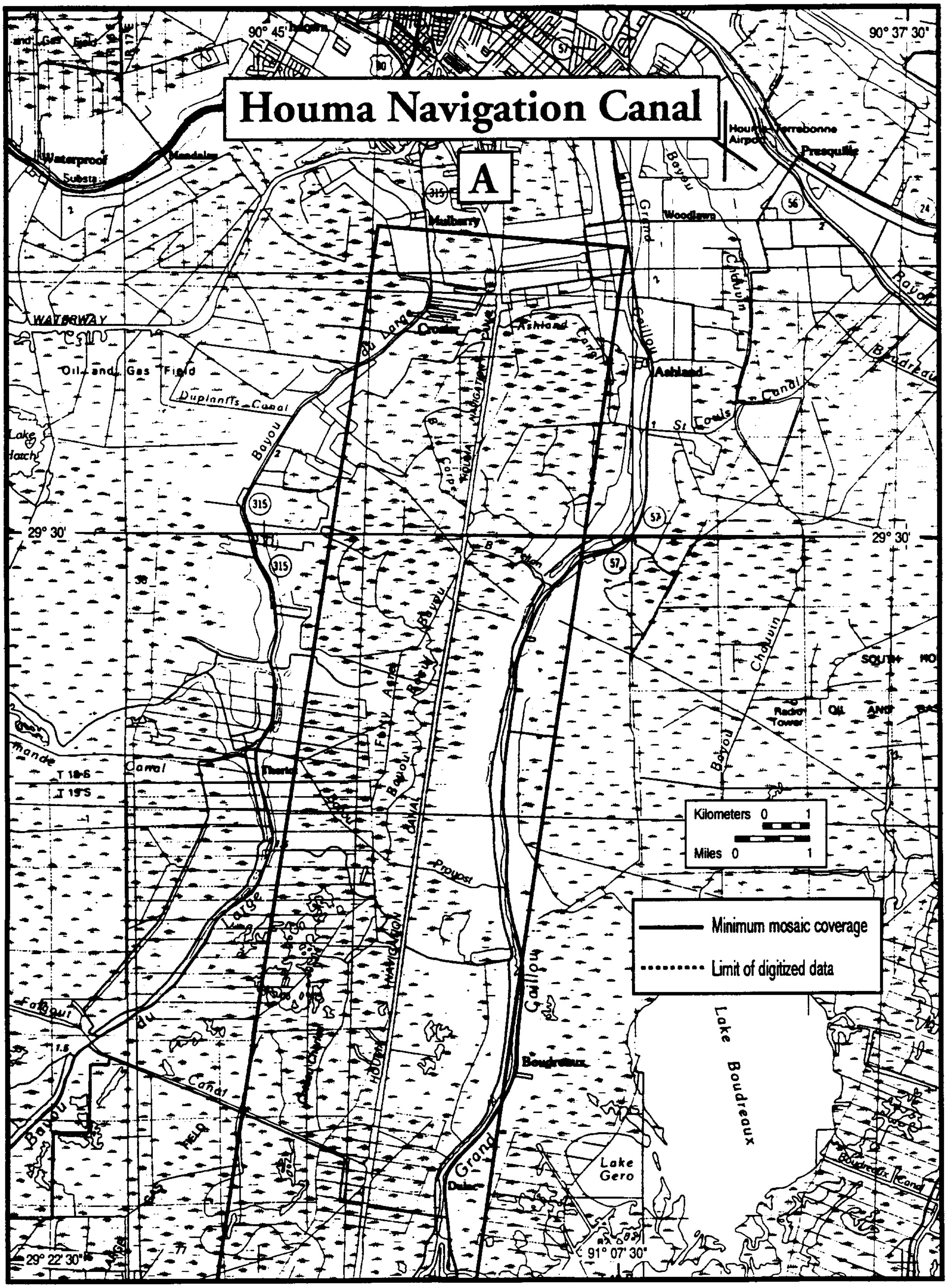


Figure 2a. The upper reach of the Houma Navigation Canal - Bay Chaland BUMP study area showing the minimum coverage of the aerial photo-mosaic.

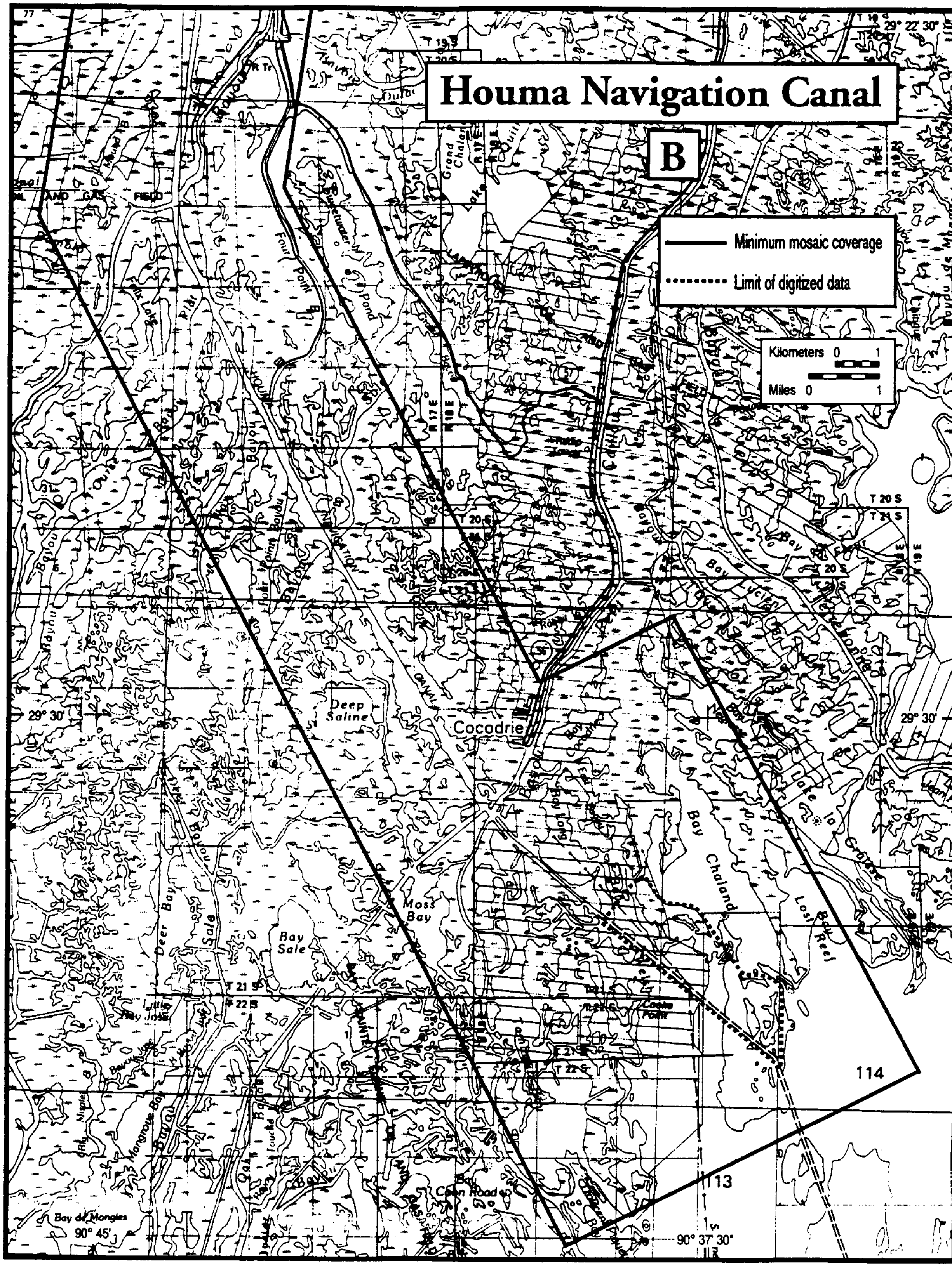


Figure 2b. The lower reach of the Houma Navigation Canal - Bay Chaland BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized.

DREDGED MATERIAL DISPOSAL HISTORY

Material dredged from the Houma Navigation Canal during maintenance is routinely deposited along and behind the banks creating elevated ridges of upland, and later, forested habitats. Maintenance in the Bay Chaland Area consisits of maintaining a channel -15 MLG deep by 150 feet wide from Mile 12 to Mile 4.1. Beneficial use of dredged material from maintenance of the navigation channel is placed in semi-confined, diked areas adjacent to marsh on the east and north side of the channel along Bay Chaland in a manner conducive to wetland creation. Maintenance dredging takes place every two years and was last dredged in FY1993 and in FY1995. Figure 3 illustrates the dredged material disposal history for the study areas since 1990.

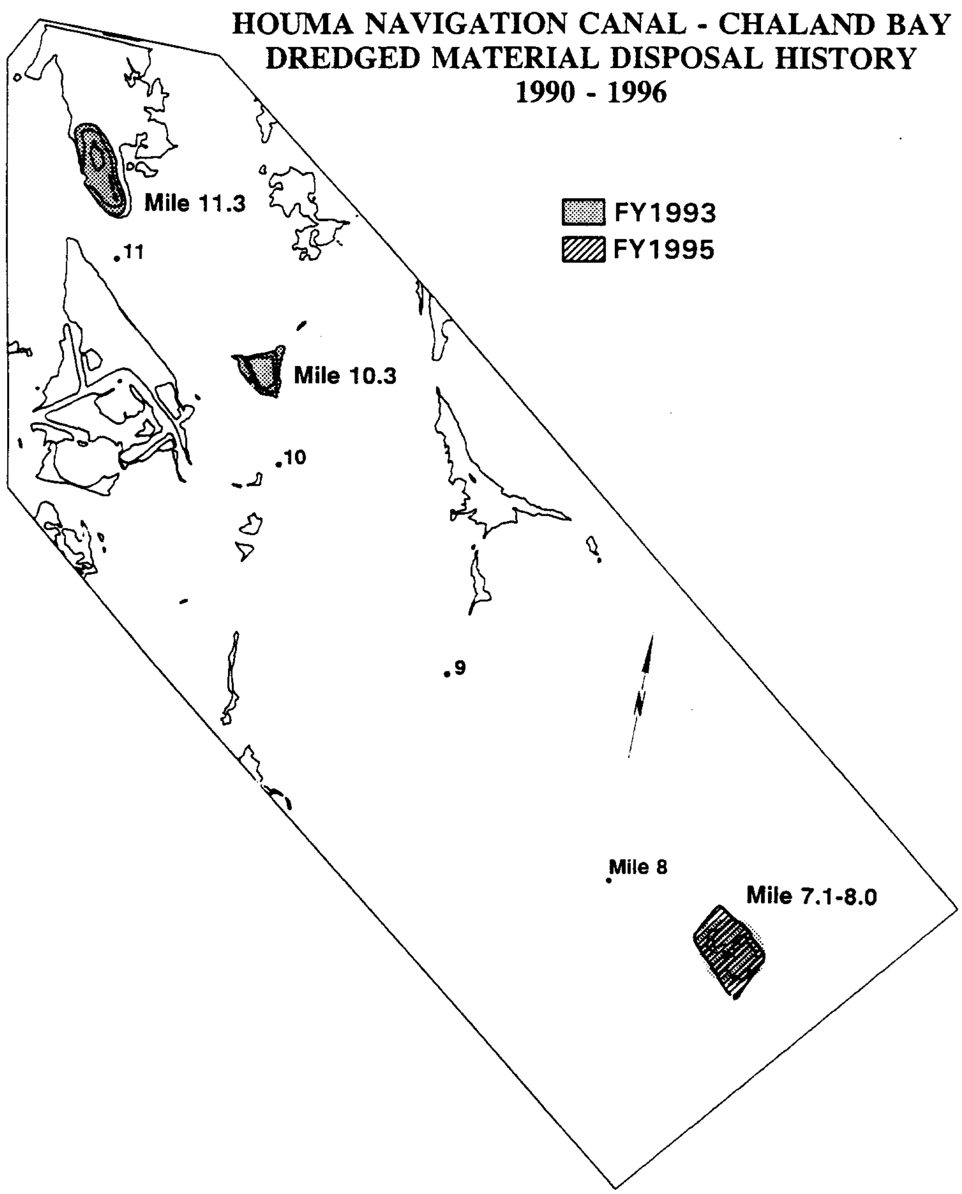


Figure 3. The dredged material disposal history for the Houma Navigation Canal- Bay Chaland study area.

FIELD SURVEY RESULTS

Methodology

Elevation Profile Surveys

The BUMP study area is located where the Houma Navigation Canal passes through Bay Chaland south of Cocodrie, Louisiana (Figure 2). The collection of elevation and vegetation profile surveys was conducted in two phases. Phase-I involved assessing the characteristics of various beneficial use disposal areas to determine the most applicable sites to document the beneficial use of dredged materials and habitat development. This was accomplished by discussion with the USACE-NOD, reviewing vertical aerial photography, and reviewing dredging schedules and history. Based on these factors, two areas were selected: the site at Mile 11.3 to the north and Mile 7.1-8.0 to the south. One transect line was positioned on each site along the lateral axes (Figure 4). One stake was placed along the rock dyke at the channel side of each site to define the transect line, recording secondary features such as towers or navigation markers to assist in relocating the transects should the vegetation become taller or thicker. Permanent 1-inch diameter by 6-foot galvanized stakes were buried approximately 1 feet in the rock dyke and secured with more rocks. Temporary white, ten-foot PVC poles with flagging and neon orange paint were slipped over the galvanized stakes to make profile siting and re-location easier.

Phase-II involved the actual collection of profile datum. In September 1996, profile surveys were conducted along the transects defined by the stakes during phase-I. One transect profile was collected from each site. Survey datum were collected using a Topcon GTS-300 $_{DPG}$ Total-Station, tri-prism, and TDS48 Data Collection System. Horizontal accuracy of the GTS-300 is 0.25 ft ± 0.0125 ft., with a vertical accuracy of 0.45 ft ± 0.0125 ft. The maximum horizontal range with tri-prism is 3,525 ft. A Pathfinder Professional MC-5 global positioning system (GPS) device was used to record the horizontal positions of each stake, instrument location, and the position and exact orientation of each transect line. The transect datum collected were processed, referenced to local tide gage, and entered into a graphic software program to produce topographic profiles.

The topographic profiles for the study area were constructed in reference to Micronautics Tide Table - Wine Island, Terrebonne Bay, Louisiana (29°5'N / 90° 37'W) (Figure 4). The mean diurnal tidal range for the Houma Navigation Canal study area is published as 1.3 ft. Profiles ranged in length from 937.2 to 1335.8 feet. Maximum relief along the profiles was 4.21 feet (MSL) along the dike at the Mile 11.3 site.

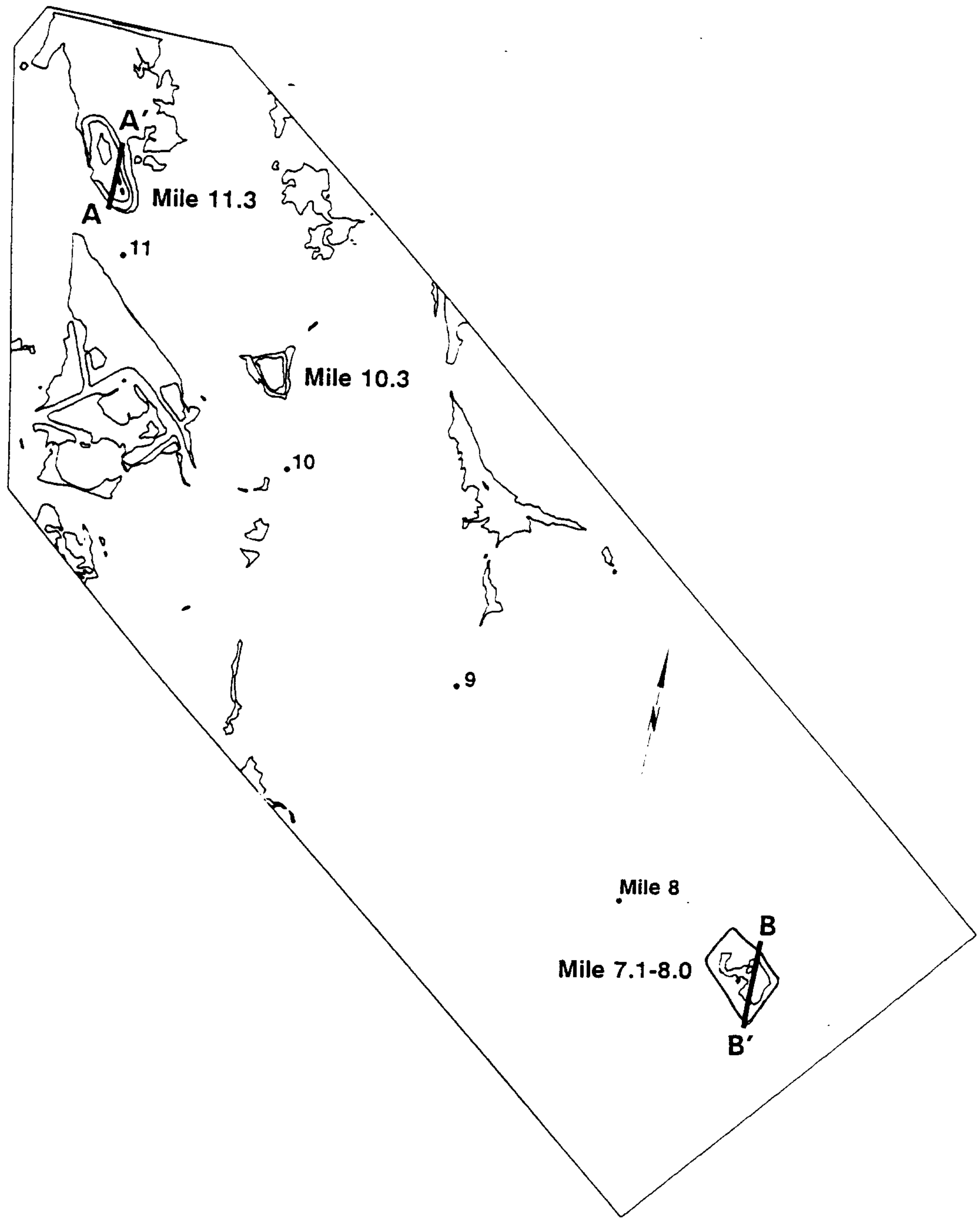


Figure 4. Location of the Houma Navigation Canal - Bay Chaland BUMP study area transects and the tide gage that was used to reference the elevation data.

Vegetation Surveys

Ground truthing for vegetative species composition and habitat verification was done in September 1996. Species composition was determined within a six-foot swath along each profile, and major divisions between vegetative communities were entered as points on the elevation profile. No submerged aquatic species were considered for this report. Plants were identified in the field with only representative specimens taken for confirmation by taxonomic keys and/or verification by the LSU Department of Plant Biology. The better specimens and uncommon specimens were entered into the LSU herbarium collection; all others were archived by the author. The percent composition of each species was visually estimated in order to determine the relative abundance and dominance of species for habitat determinations. These percentages were not intended to provide scientific ratios or statistics. The species list included in the Appendix 7A of this report is not complete; it reflects only those species that were readily observed during the profiling period. Some plants can only be identified during a short flowering period which may not have coincided with the ground truthing or the profile data collection, and therefore can not be included in the list other than by a broad classification.

Profiles

The 1996 profiles were established with metal poles (stakes) buried in the rock retaining dyke and extending 2-3 feet from the sediment surface. One stake was placed at each site to define each profile.

Bay Chaland Mile 11.3

The Bay Chaland site at Mile 11.3 is located just south of the LUMCON facility at Cocodrie, Louisiana, along the northeast side of Houma Navigation (Figure 4). The construction of this site was initiated during the USACE-NOD FY1993 maintenance event and consisted of an encircling dike that is open to tidal action at the southwest side, an adjacent encircling, shallow to intertidal lagoon, and central colonizing salmarsh (Figure 5).

The transect was delineated by 1 stake set in the southwest rock dike of the site, in line with a water tower visible on the horizon to the north. The material within the encircling dike was extremely fine, soft mud, well colonized by saltmarsh. The encircling lagoon was too shallow to float the usual two-person survey crew in a pirogue, and the substrate was too soft to traverse safely on foot.

The profile here had a length of 937.2 ft. The maximum relief along the axis is 4.21 ft MSL, with an average relief of 1.29 ft MSL. The profile indicates that the island is typically characterized as a mud flat colonized by saltmarsh.

Figure 5. Photograph of the Houma Navigation Canal - Bay Chaland Mile 11.3 BUMP study site in September 1996. This view is from the channel side dike, looking across the shallow lagoon to the semi-confined saltmarsh.

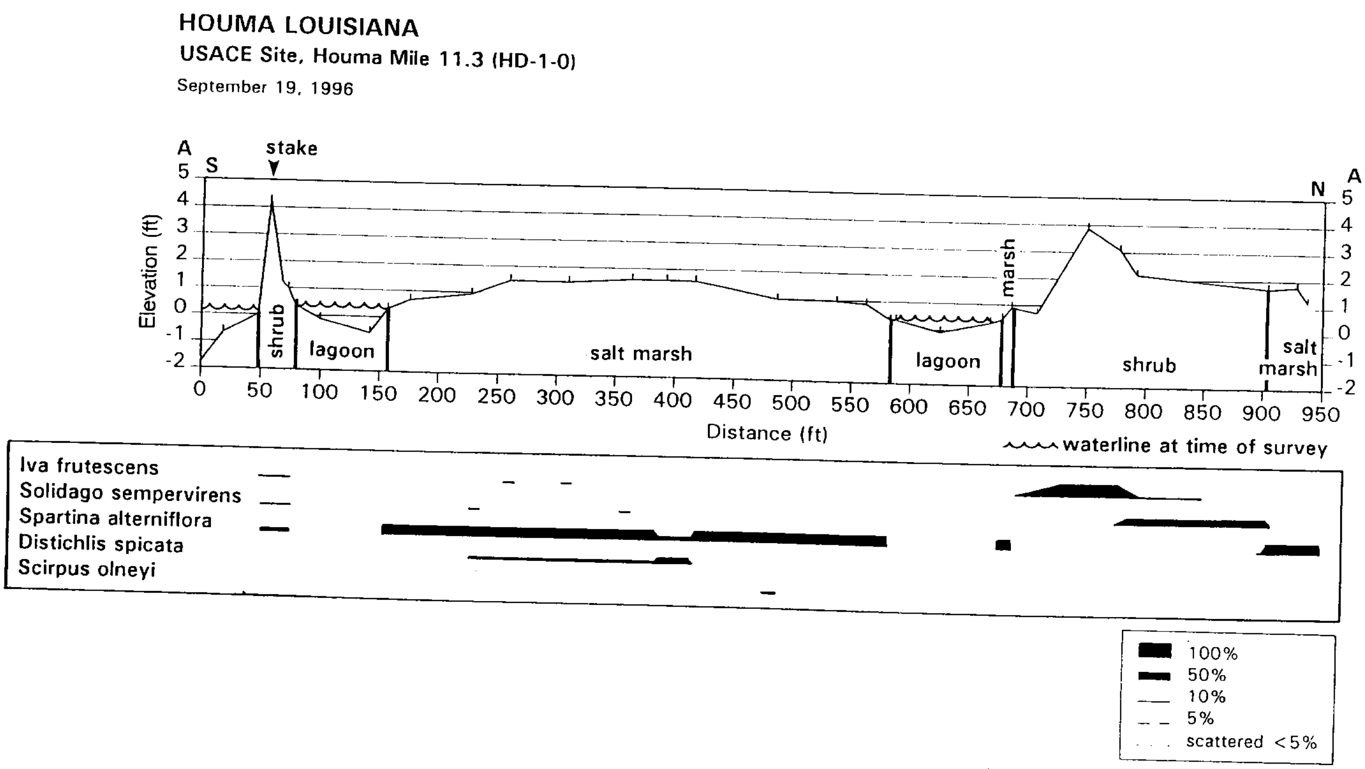


Figure 6. Elevation profile of Bay Chaland Mile 11.3 BUMP study site with vegetation data illustrated.

Houma Navigation Canal Mile 7.1 - 8.0

The site at Mile 7.1-8.0 is located along the northeast side of the Houma Navigation Canal as it passes through Bay Welsh near Lake Pelto (Figure 5). A dike was constructed around existing saltmarsh (Figure 7) and material was filled in around the marsh during the FY1993 and FY1995 maintenance events. However, the dike is incomplete in at least two places allowing tidal flow and wave action to remove much of the placed material.

The transect was delineated by one stake set in the rock levee on the northeast side of the site, and was aligned due south along the series of survey stakes placed within the existing marsh by the dredging survey crews (Figure 8).

The profile here was 1335.8 ft. The maximum relief was 2.5 ft MSL, with an average relief of .88 ft MSL. The profiles indicate that the island is typically characterized as a low relief saltmarsh (Figure 8). The encircling lagoon between the existing marsh and the rock dyke is deeper than that of the Bay Chaland site, and appears to have considerably more tidal action. No new marsh colonization was observed during the time of the transect.

Figure 7. Photograph of the Houma Navigation Canal Mile 7.1-8.0 BUMP study site taken in September 1996, showing the rock dike that partially encloses the existing natural marsh.

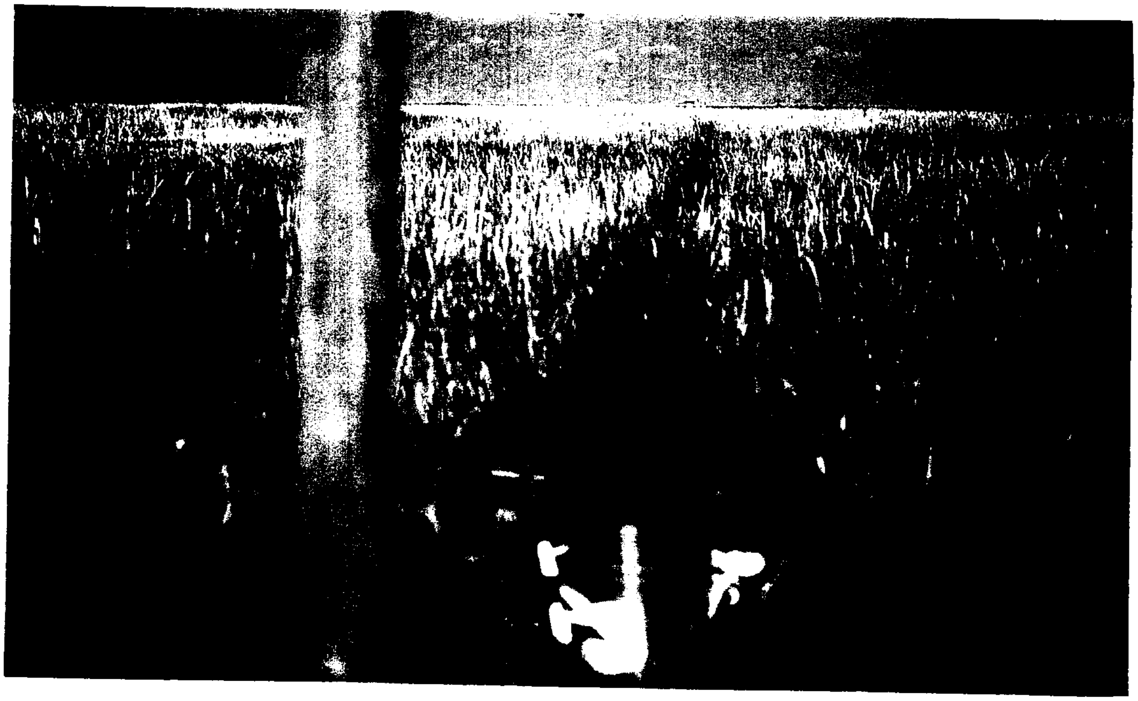


Figure 8. Photograph of the Houma Navigation Canal Mile 7.1-8.0 BUMP study site taken in September 1996, showing the transect line that is in line with survey markers left by a previous crew.

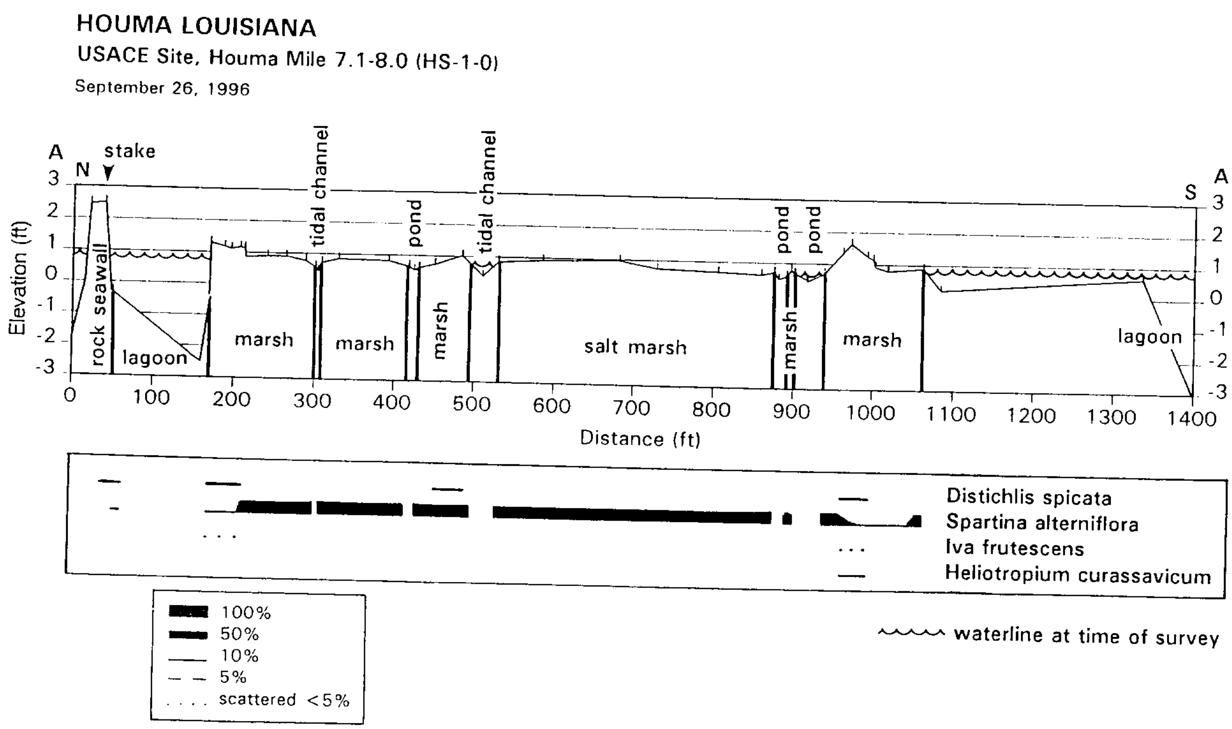


Figure 9. Elevation profile of the Houma Navigation Canal Mile 7.1-8.0 BUMP study site with vegetation data illustrated.

Vegetative Character

General Description

The beneficial use sites consisted of placing dredged material adjacent to deteriorating marsh within a retaining dyke. Once the fine material settled and compacted, the dyke was broken to restore tidal flow to the enclosed marsh. The overall marsh type for this area is classified as salt marsh. During the time of the field survey, Oyster grass (*Spartina alterniflora*) and salt grass (*Distichlis spicata*) dominated the vegetative community.

The material deposited in the Bay Chaland Mile 11.3 site appeared to have been successful in inducing saltmarsh colonization. However, the material deposited within the Mile 7.1-8.0 site appears to have been reworked or removed by the constant tidal action and had not induced any additional colonization at the time of the elevation transect..

Vegetative community types

The low salt marsh in the study area is inundated by daily tides and is dominated by Oyster grass (*Spartina alterniflora*) and salt grass (*Distichlis spicata*).

The older levee around the Bay Chaland site provided an upland habitat for vegetative growth and supported a dense shrub/scrub community consisting mainly of *Iva frutescens* and *Solidago sempervirens*.

GIS ANALYSIS RESULTS

Shoreline Changes: 1990-1996

Figure 10 graphs the spatial history of the Houma Navigation Canal - Bay Chaland (HNC) BUMP study area between 1990 and 1996, depicted in Table 1 and illustrated in Figure 11. In December 1990, the HNC study area was measured at 423.0 acres. The study area in November 1996 was measured at 349.3 acres. This is a cumulative area decrease of 73.7 acres or a decrease in area of 17.4 percent for the 5.9 year period at an overall rate of change of 12.5 acres per year. There was an overall loss of 76.0 acres of natural habitats and a loss of 2.2 acres of non-BUMP man-made habitats, offset by the creation of +4.5 acres due to the beneficial use of dredged materials. Without the contribution of new habitats due to the beneficial placement of dredged material, the total coastal land loss in the study area would have exceeded -76 acres at a rate of -12.89 acres per year, which is equivalent to a 4 percent loss of the area per year.

Between December 1990 and February 1995, the total area of HNC decreased by 57.2 acres at a rate of 11.44 acres per year for this 5 year period. The primary areas of progradation took place along the eastern margin of the HNC navigation channel. Land loss was associated with HNC channel widening and erosion along the island edges of the study area.

Between February 1995 and October 1995, the area of HNC study area for this 0.58 year time period decreased by 13.6 acres at a rate of 23.5 acres per year. Land gain occurred primarily in the beneficial use disposal areas. Land loss occurred sporadically in the southern portion of the study area as edge erosion.

Between October 1995 and November 1996, the HNC study area decreased by 2.9 acres over one year. Land gain occurred primarily in the beneficial use areas. Land loss took the form of edge erosion along the channel margins and the margins of the islands.

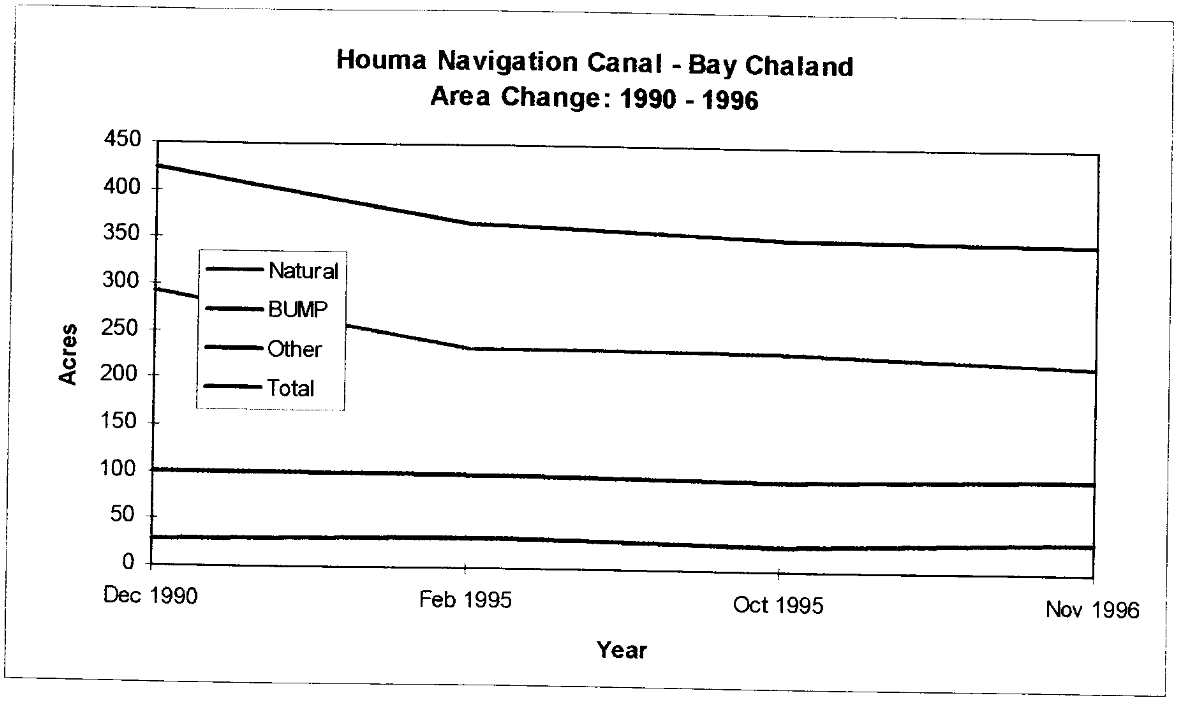
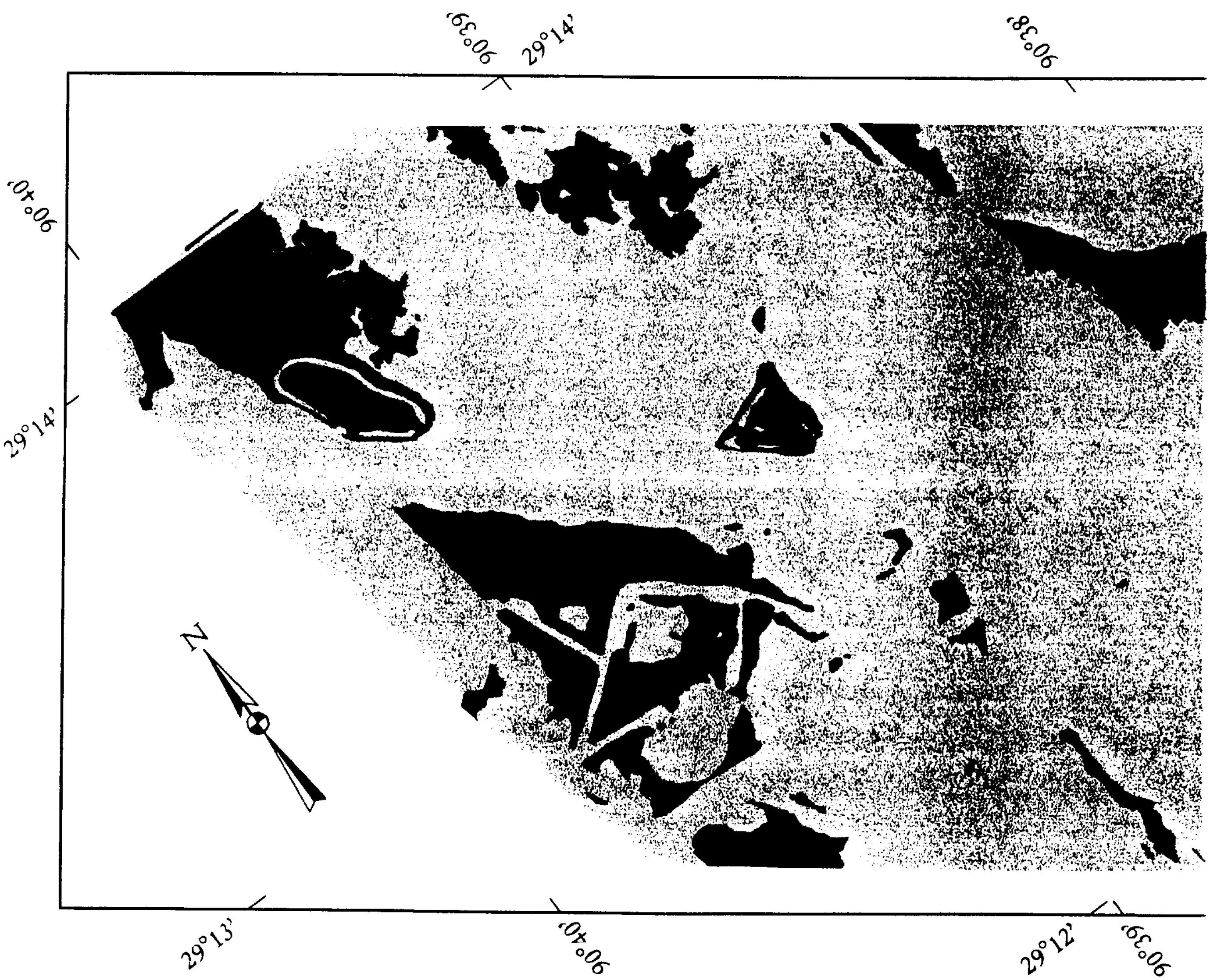


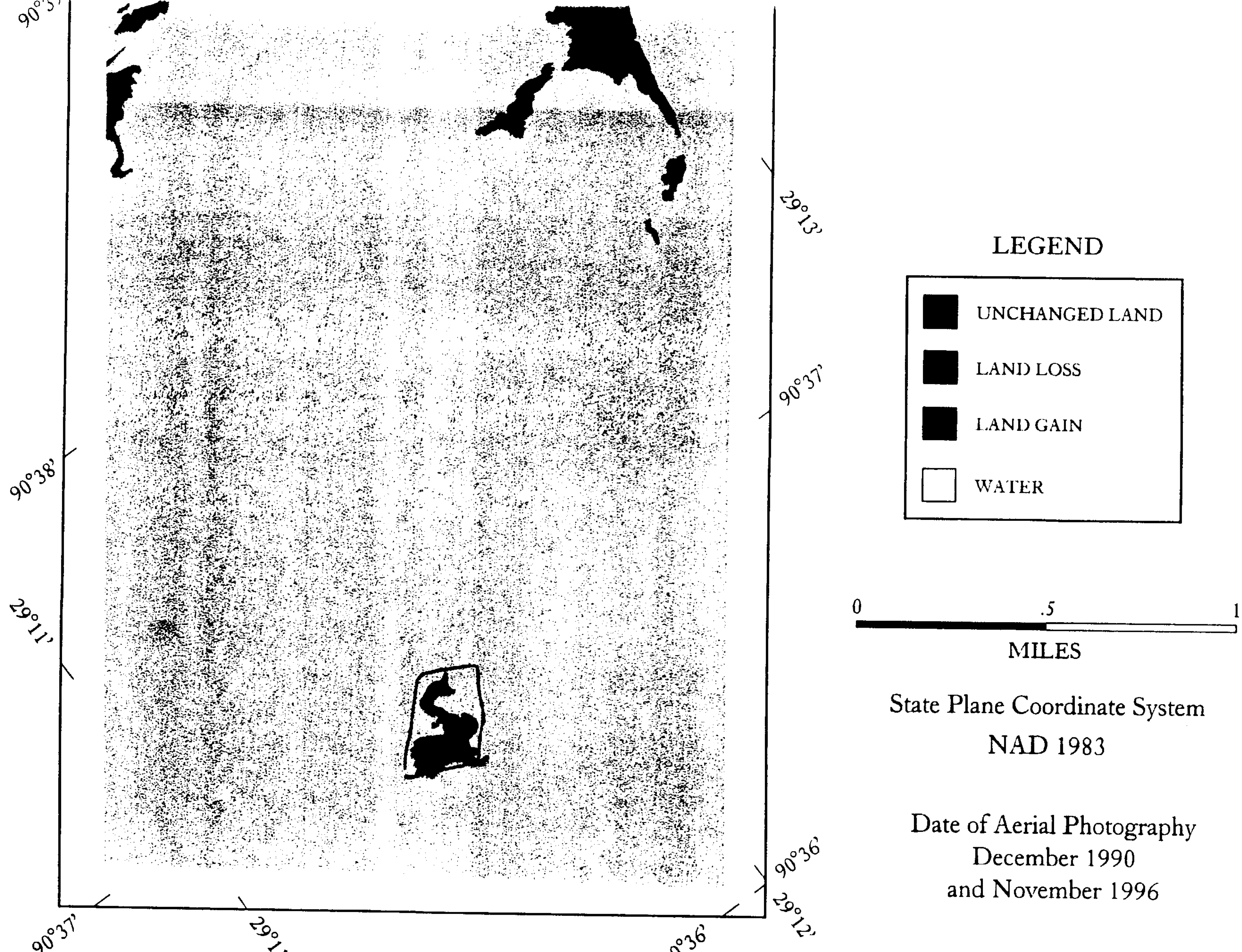
Figure 10. Graph of the area of the Houma Navigation Canal - Bay Chaland BUMP study area over time. The green line graphs the total natural area excluding areas created by beneficial use of dredged materials and other man-made areas.

TABLE 1
Houma Navigation Canal - Bay Chaland Area: 1990-1996

Area in Acres	Dec 1990	Feb 1995	Oct 1995	Nov 1996
Natural Areas	293.5	232.8	232.4	217.5
BUMP Man-made Areas	27.7	33.9	25.7	32.2
Non-BUMP Man-made Areas	101.8	99.1	94.1	99.6
Total	423.0	365.8	352.2	349.3



1



②

Figure 11. Shoreline change history for the Houma Navigation Canal - Bay Chaland BUMP study area between December 1990 and November 1996.

Habitat Inventory

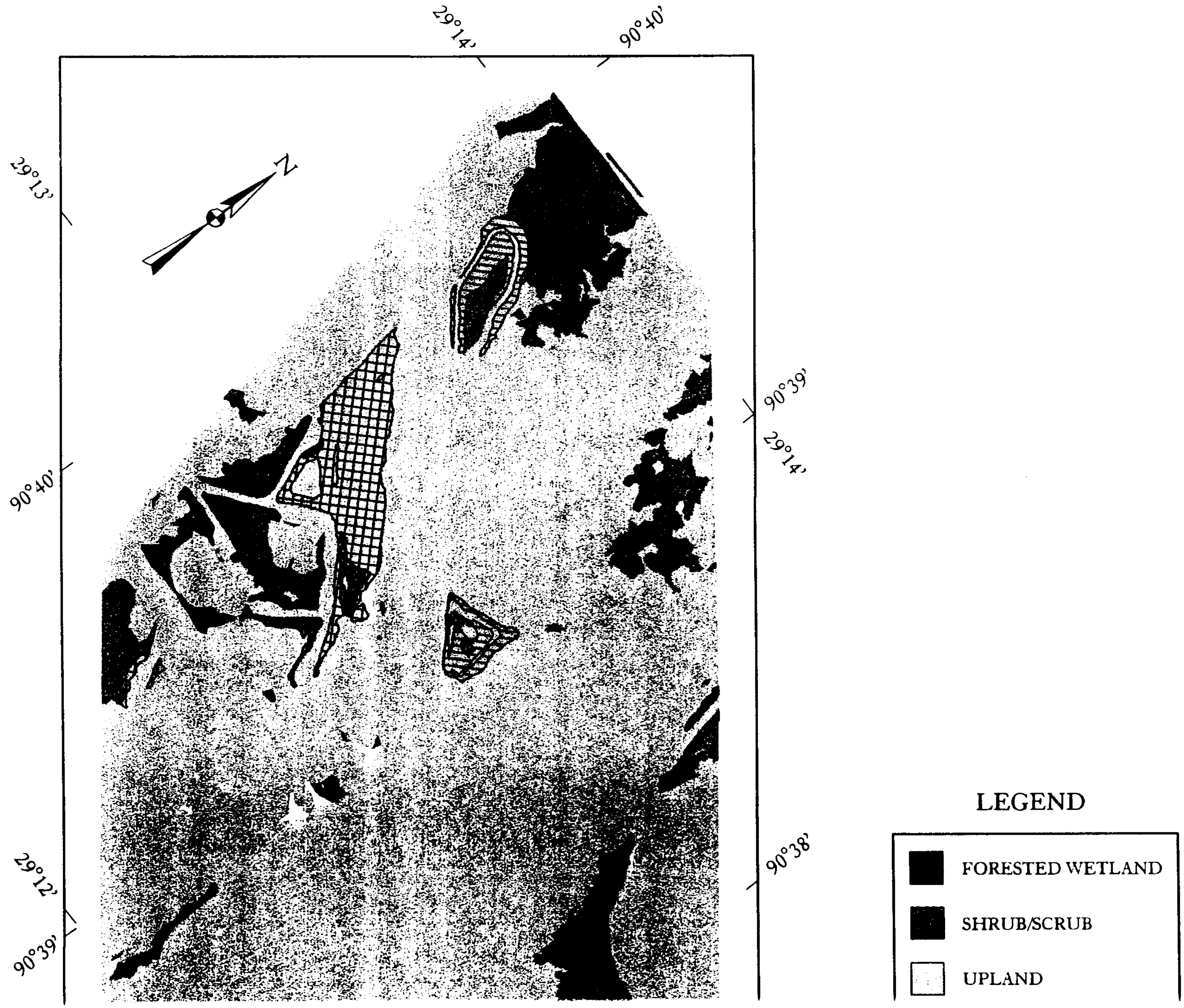
The aerial photographic interpretation combined with field surveys identified six major habitat types in the Houma Navigation Canal - Bay Chaland BUMP (HNC) study area. These habitats are further classified as natural and man-made. The natural class identifies natural deltaic processes as responsible for habitat creation. The BUMP man-made (BUMP-made) class identifies the habitats created by the beneficial use of dredged material. The non-BUMP man-made (other-made) class identifies areas created as a result of activities other than BUMP, such as areas associated with the oil industry access and pipeline canals. On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

Table 2 lists the areas of the five habitat types found in the HNC study area in December 1990. The location and arrangement of these habitats is presented in figure 12. The total area of the HNC study area in December 1990 was 423.0 acres. Of this total, 293.5 acres were natural and 129.5 acres were man-made including 27.7 acres BUMP-made and 101.8 acres of other-made or 69.3 percent were natural, 5.0 percent were BUMP-made and 24.1 percent was other-made. In order of decreasing size and importance, the largest habitat found was natural marsh (277.0 acres) followed by other-made upland (66.5 acres), other-made shrub/scrub (28.4 acres), BUMP-made bare land (19.9 acres), natural upland (11.5 acres), BUMP-made upland (7.8 acres), other-made marsh (6.9 acres), natural beach (4.2 acres) and natural shrub (0.8 acres).

In terms of habitat totals, marsh (283.9 acres or 67.1%) dominated the Houma - Bay Chaland landscape.

TABLE 2
December 1990 Habitat Inventory of the Houma - Bay Chaland BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	283.9	277.0	6.9	0
Upland	85.8	11.5	66.5	7.8
Shrub/Scrub	29.2	0.8	28.4	0
Beach	4.2	4.2	0	0
Bare Land	19.9	0	0	19.9
Habitat Total	423.0	293.5	101.8	27.7


29°14'
90°40'
29°13'
N
90°39'
29°14'
90°40'
29°12'
90°39'
90°38'
LEGEND
FORESTED WETLAND
SHRUB/SCRUB
UPLAND

1

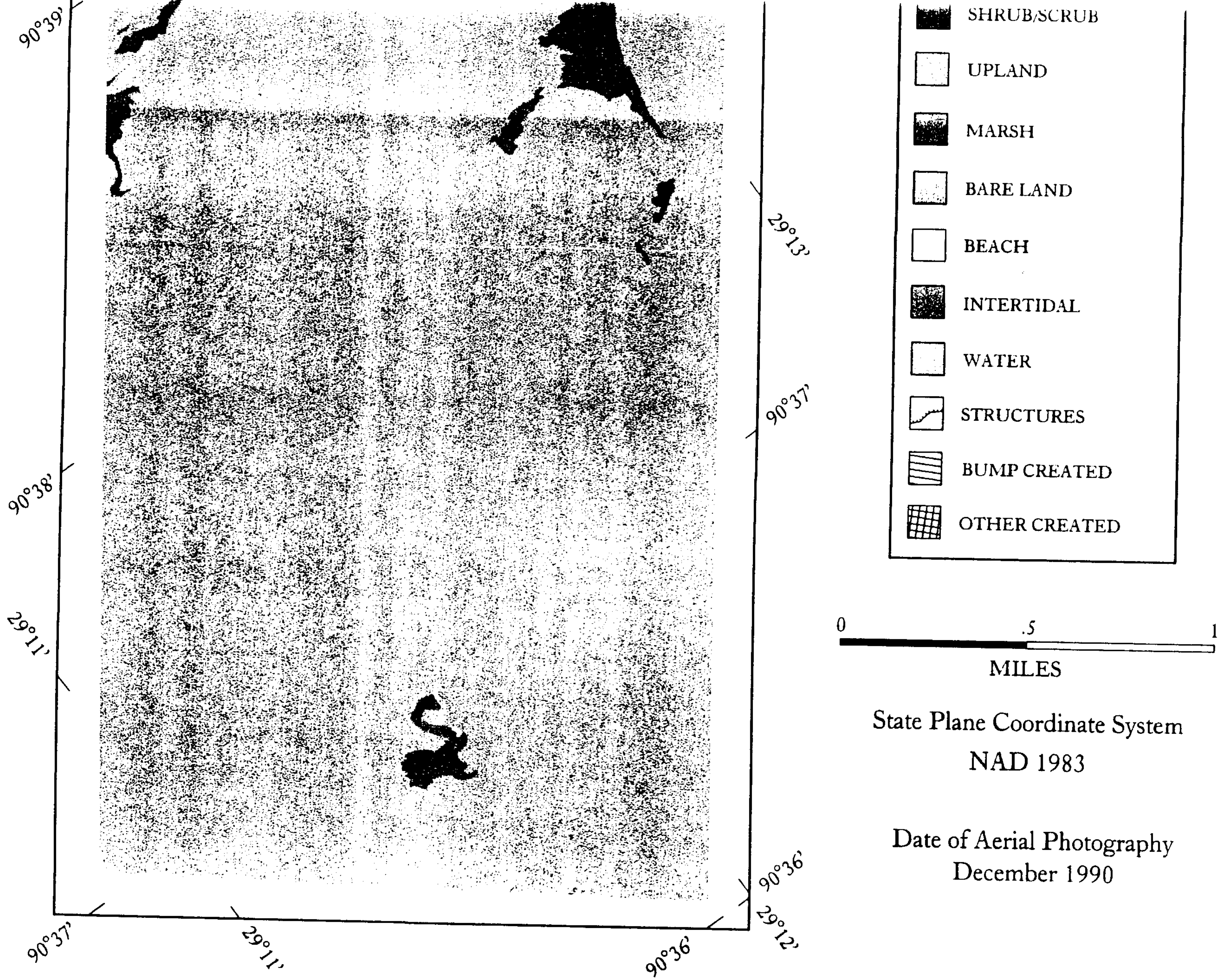


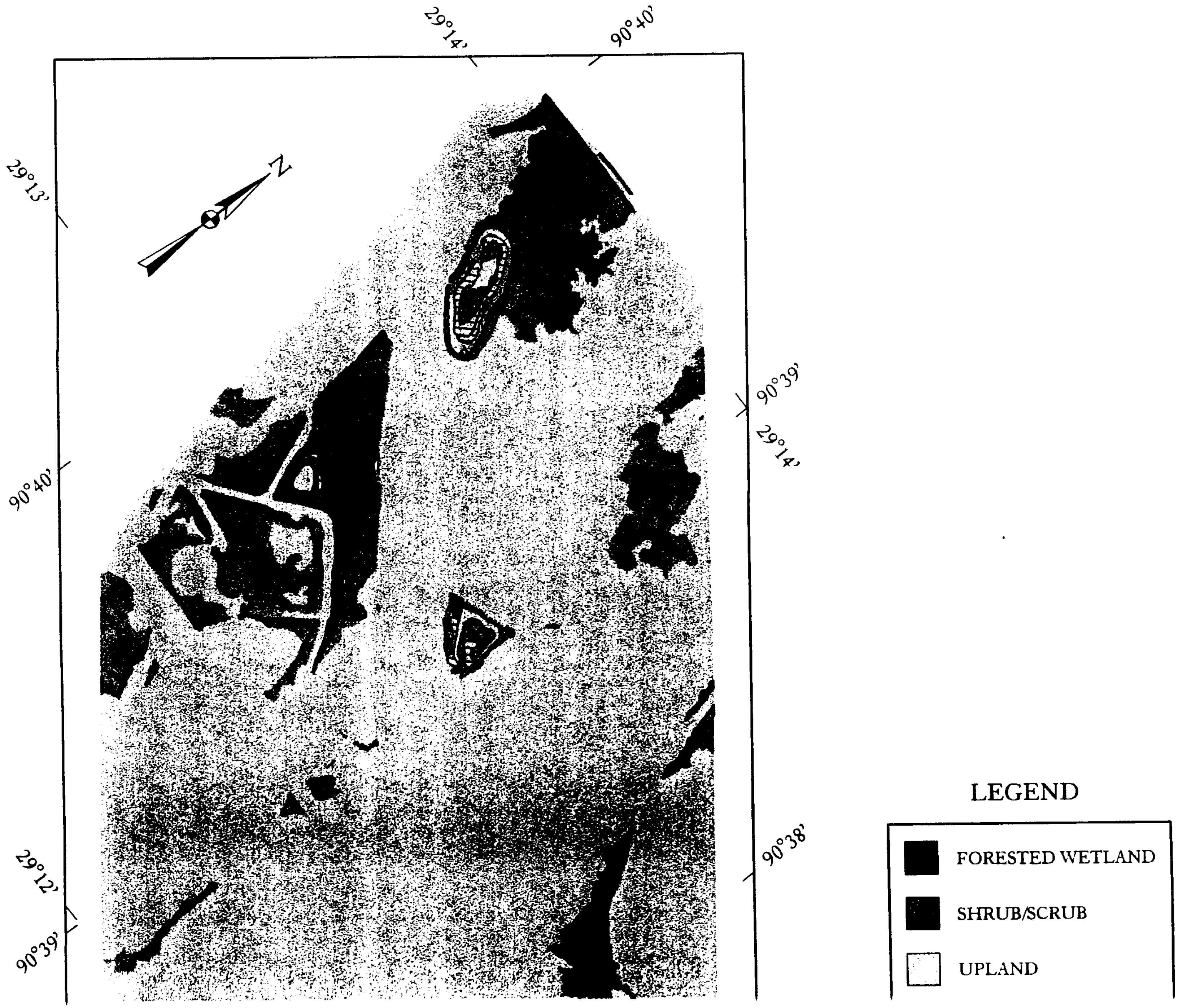
Figure 12. Habitat inventory map of the Houma Navigation Canal - Bay Chaland BUMP study area in December 1990.

Table 3 lists the areas of the five habitat types found in the HNC study area in February 1995. The location and arrangement of these habitats is presented in Figure 13. The total area of the HNC study site was measured at 365.8 acres. Of this total, 232.8 acres were natural and 133.0 acres were man-made including 99.1 acres other-made and 33.9 acres of BUMP-made, or 63.6 percent were natural, 27.1 percent was other-made, and 9.3 percent were BUMP-made. In order of decreasing size and importance, the largest habitat found was natural marsh (212.2 acres) followed by other-made shrub/scrub (90.2 acres), natural upland (19.7 acres), BUMP-made marsh (13.2 acres), BUMP-made shrub/scrub (10.4 acres), other-made marsh (8.0 acres), BUMP-made upland (7.3 acres), BUMP-made bare land (3.0 acres), other-made upland (0.9 acres), natural shrub/scrub (0.7 acres), and natural beach (0.2 acres).

In terms of habitat totals, marsh (233.4 acres or 63.8%) dominated the Houma - Bay Chaland landscape.

TABLE 3
February 1995 Habitat Inventory of the Houma - Bay Chaland Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	233.4	212.2	8.0	13.2
Upland	27.9	19.7	0.9	7.3
Shrub/Scrub	101.3	0.7	90.2	10.4
Beach	0.2	0.2	0.0	0.0
Bare Land	3.0	0.0	0.0	3.0
Habitat Total	365.8	232.8	99.1	33.9



29°14'
90°40'
29°13'
N
90°39'
29°14'
90°40'
29°12'
90°39'
90°38'
LEGEND
FORESTED WETLAND
SHRUB/SCRUB
UPLAND

①

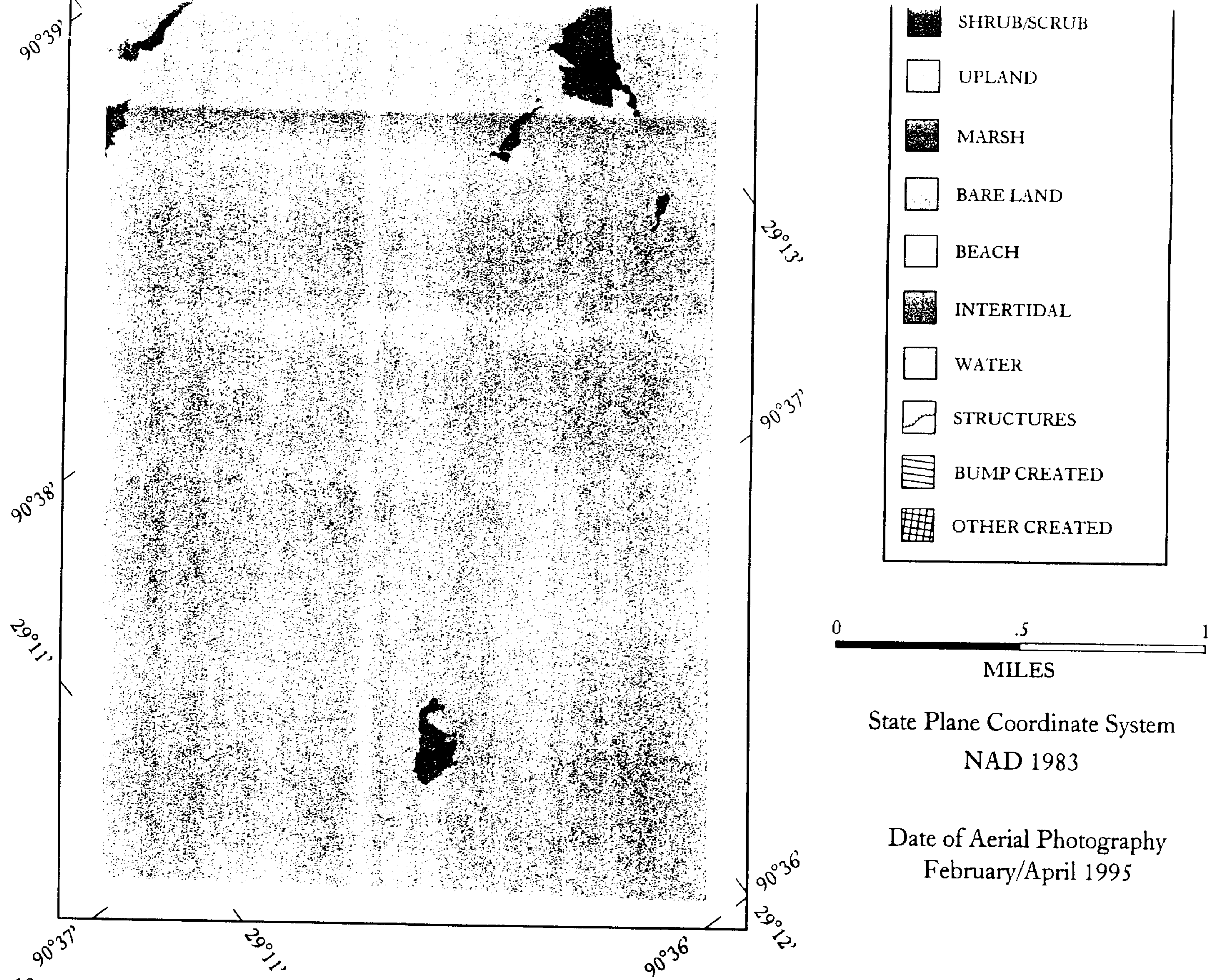


Figure 13. Habitat inventory map of the Houma Navigation Canal - Bay Chaland BUMP study area in February 1995.

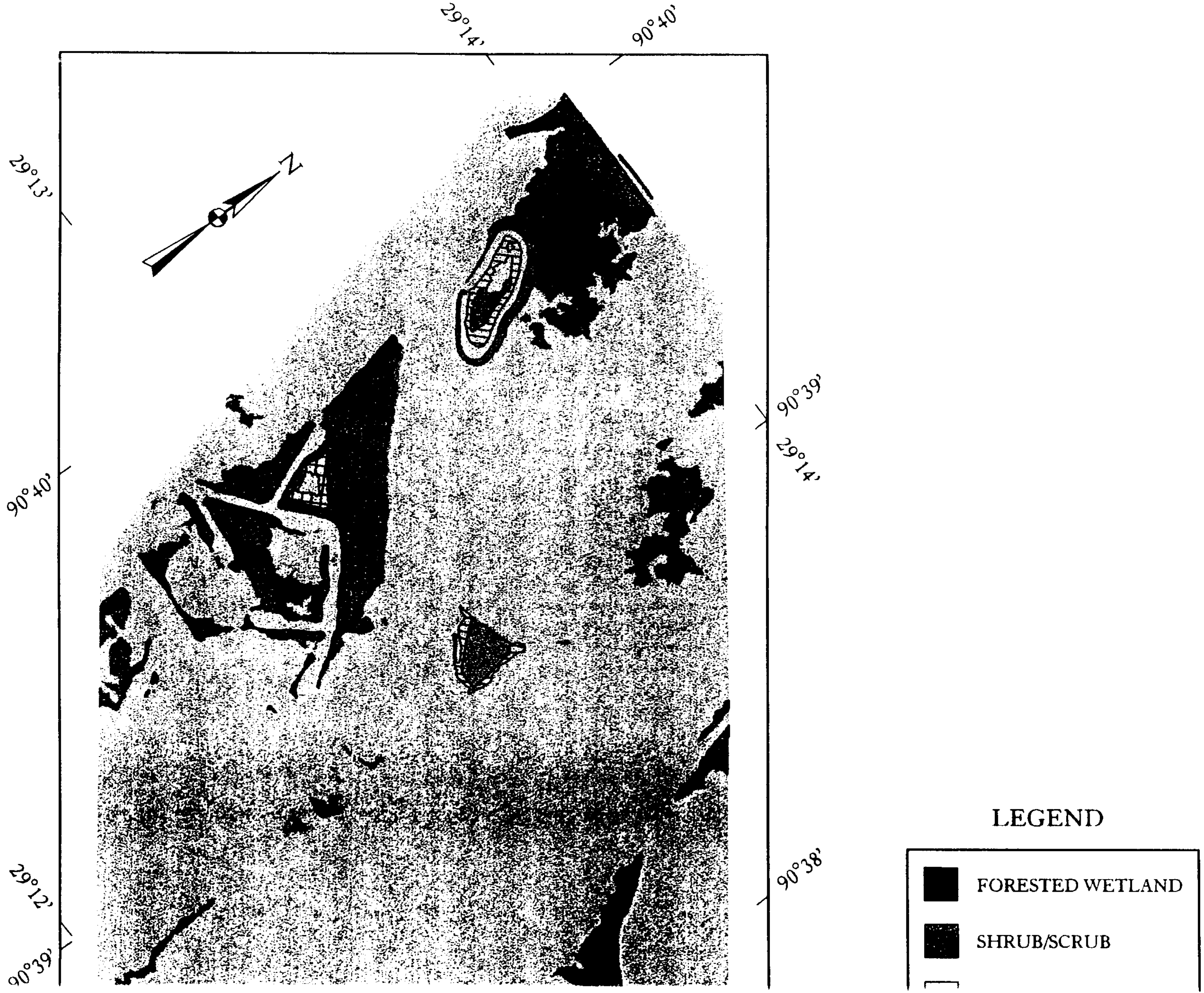
2

Table 4 lists the areas of the four habitat types found in the Houma Navigation Canal -Bay Chaland (HNC) BUMP study area in October 1995. The location and arrangement of these habitats are presented in figure 14. The total area of the HNC study site in October 1995 was 351.7 acres. Of this total, 226.7 acres were natural and 125.0 acres were man-made including 24.8 acres of BUMP-made and 100.2 acres of other-made, or 64.5 percent were natural, 7.1 percent were BUMP-made, and 28.5 percent were other-made. In order of decreasing size and importance, the largest habitat found was natural marsh (210.6 acres) followed by other-made shrub/scrub (90.9 acres), natural upland (15.9 acres), BUMP-made upland (11.8 acres), BUMP-made shrub/scrub (9.3 acres), other-made marsh (4.8 acres), other-made upland (4.5 acres), BUMP-made marsh (3.7 acres), and natural shrub/scrub (4.5 acres). There was no bare land measured during this time period.

In terms of habitat totals, marsh (219.1 acres or 62.3%) dominated the Houma - Bay Chaland landscape.

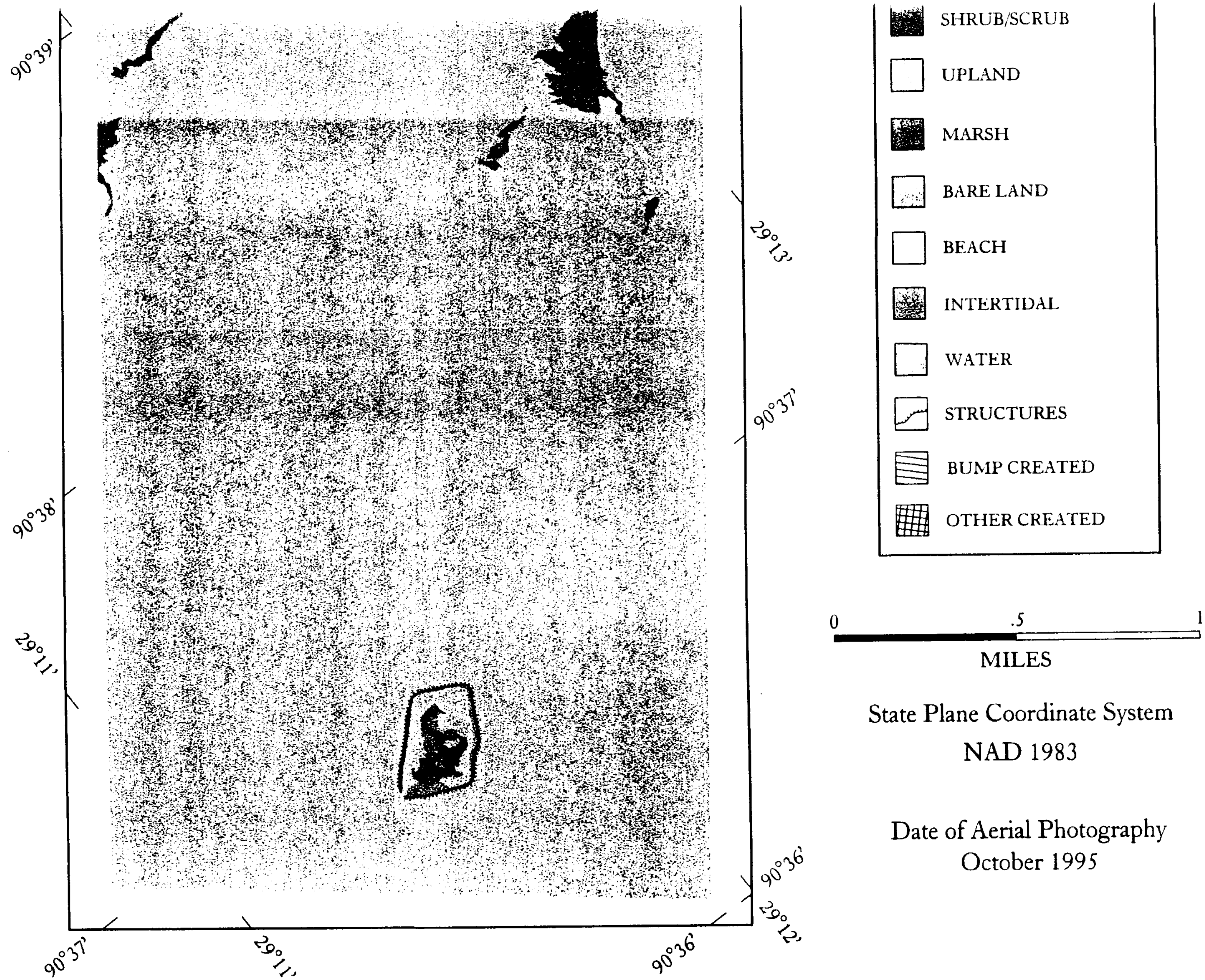
TABLE 4
October 1995 Habitat Inventory of the Houma - Bay Chaland BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	219.2	214.6	0.0	4.6
Upland	32.2	15.9	4.5	11.8
Shrub/Scrub	100.7	1.8	89.6	9.3
Beach	0.1	0.1	0.0	0.0
Bare Land	0.0	0.0	0.0	0.0
Habitat Total	352.2	232.4	94.1	25.7



29°14'
90°40'
29°13'
N
90°39'
29°14'
90°40'
90°38'
29°12'
90°39'
LEGEND
FORESTED WETLAND
SHRUB/SCRUB

(1)



2

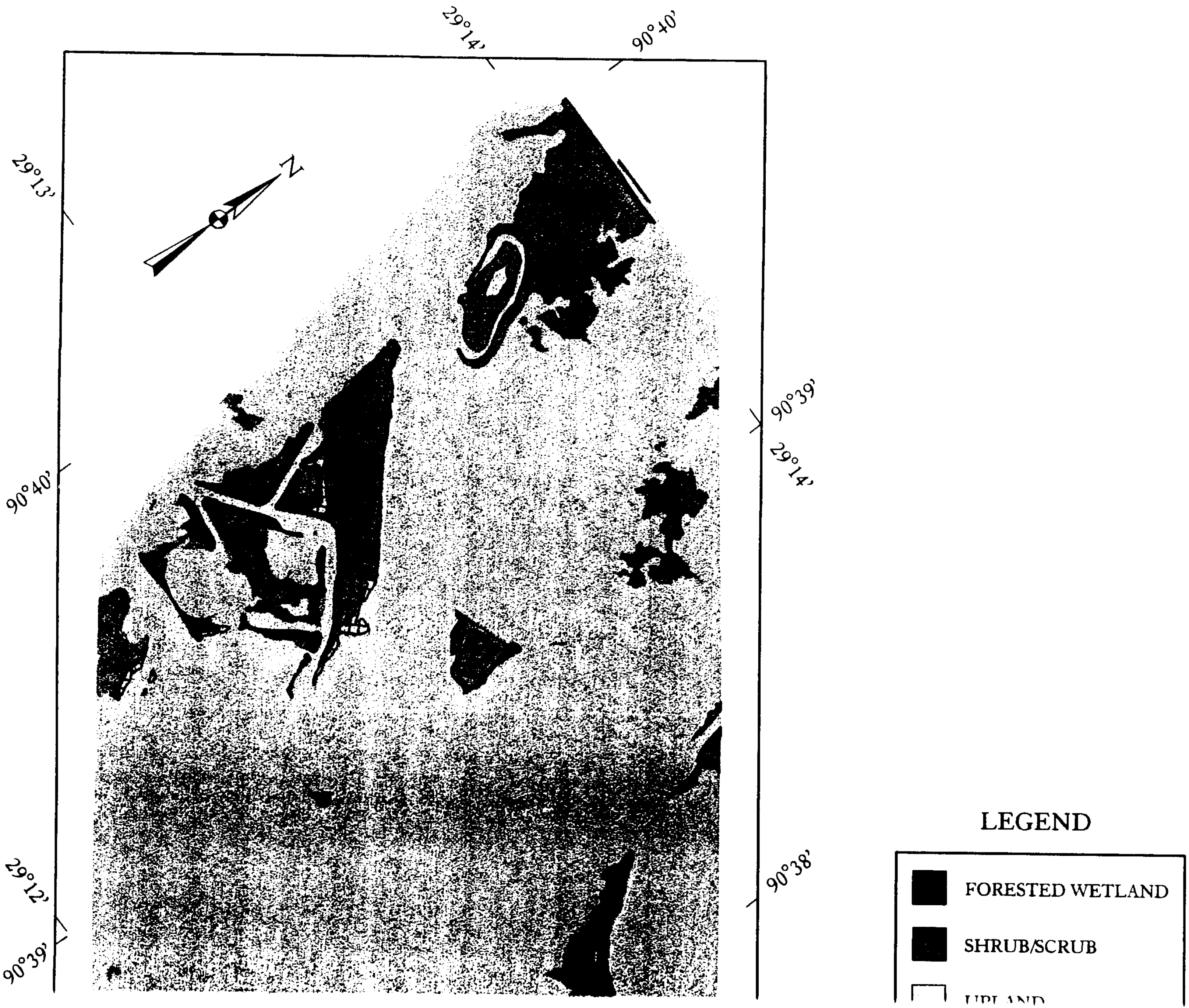
Figure 14. Habitat inventory map of the Houma Navigation Canal - Bay Chaland BUMP study area in October 1995.

Table 5 lists the areas of the four habitat types found in the Houma Navigation Canal - Bay Chaland BUMP (HNC) study area in November 1996. The location and arrangement of these habitats is presented in figure 15. The total area of the HNC study site in November 1996 was 349.2 acres. Of this total, 217.5 acres were natural and 131.8 acres were man-made including 32.2 acres BUMP-made and 99.6 acres other-made, or 62.3 percent were natural, 9.2 percent were BUMP-made, and 28.5 percent were other-made. In order of decreasing size and importance, the largest habitat found was natural marsh (190.8 acres) followed by other-made shrub/scrub (83.7 acres), natural upland (26.7 acres), BUMP-made marsh (18.7 acres), BUMP-made shrub/scrub (13.5 acres), other-made upland (8.3 acres), other-made marsh (7.3 acres), and other-made beach (0.3 acres). There was no bare land measured.

In terms of habitat totals, marsh (216.8 acres or 62.1%) dominated the Houma -Bay Chaland landscape.

TABLE 5
November 1996 Habitat Inventory of the Houma - Bay Chaland BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	216.8	190.8	7.3	18.7
Upland	35.0	26.7	8.3	0.0
Shrub/Scrub	97.2	0.0	83.7	13.5
Beach	0.3	0.0	0.3	0.0
Bare Land	0.0	0.0	0.0	0.0
Habitat Total	349.2	217.5	99.6	32.2


29°14'
90°40'
29°13'
N
90°39'
29°14'
90°40'
90°38'
29°12'
90°39'
LEGEND
FORESTED WETLAND
SHRUB/SCRUB

1

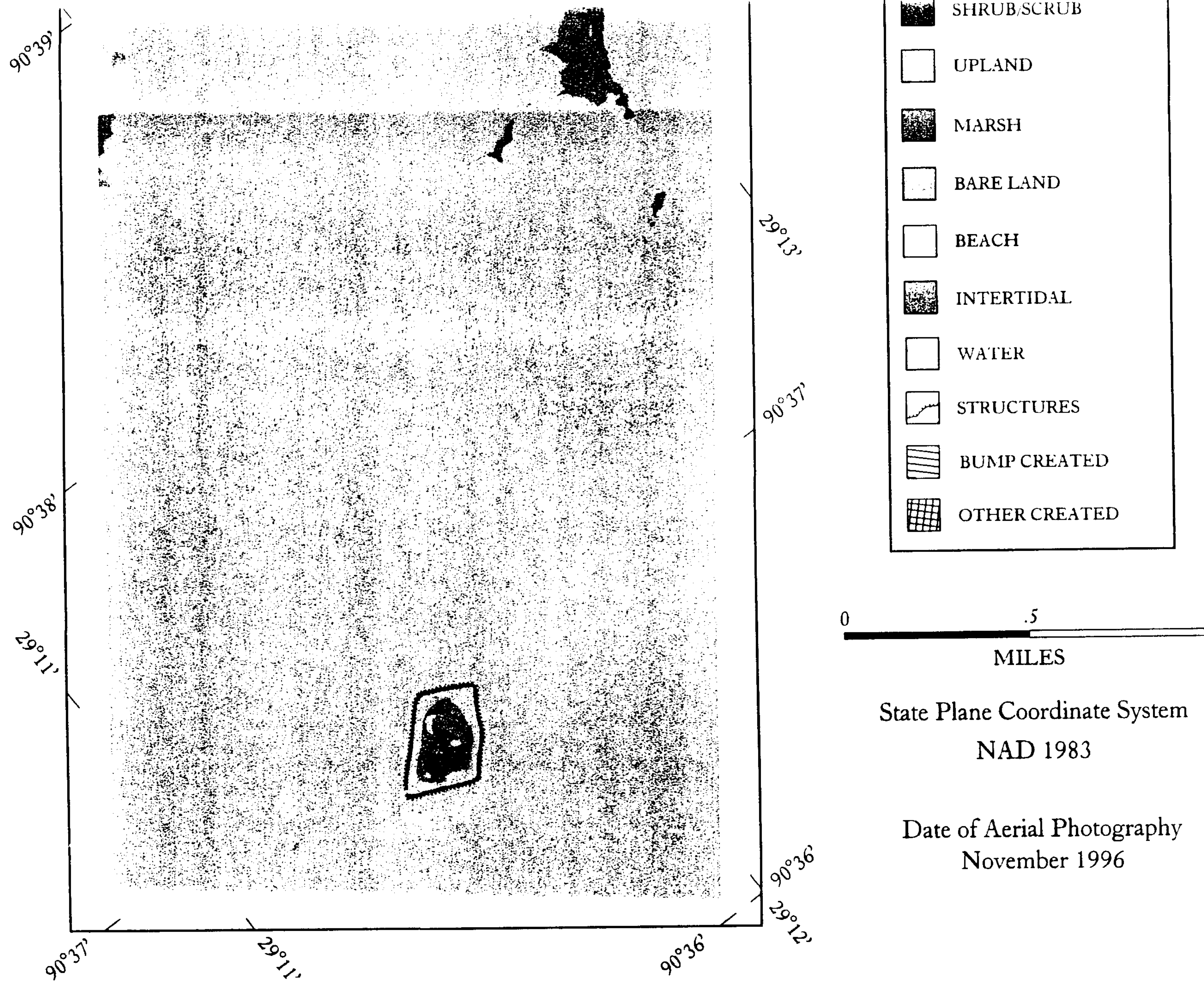


Figure 15. Habitat inventory map of the Houma Navigation Canal - Bay Chaland BUMP study area in November 1996.

2

Habitat Change

Erosion due to natural processes dominates the processes of this area. The total area decreased by 73.7 acres between 1990 and 1996 which represents a 17 percent decrease in area. There was an overall -76.0 acres of decrease of the natural habitats and a -2.2 acre decrease of non-BUMP man-made habitats, offset by an overall +4.5 acres of increase in BUMP-made habitats. Table 6 lists the major habitat changes.

In terms of changes in natural area, the marshes decreased by -87.27 acres, the beaches by -4.2 acres, and the shrub/scrub by -0.8 acres. The only area of land gain is in upland at +15.2 acres. The total decrease in natural habitats is -76.0 acres.

For the other man-made habitats, in decreasing order, there was a gain of +55.3 acres of shrub/scrub, +0.4 acres of marsh, no change in bare land, +0.3 acres of beach, and -558.2 acres of upland for a total loss of -2.2 acres.

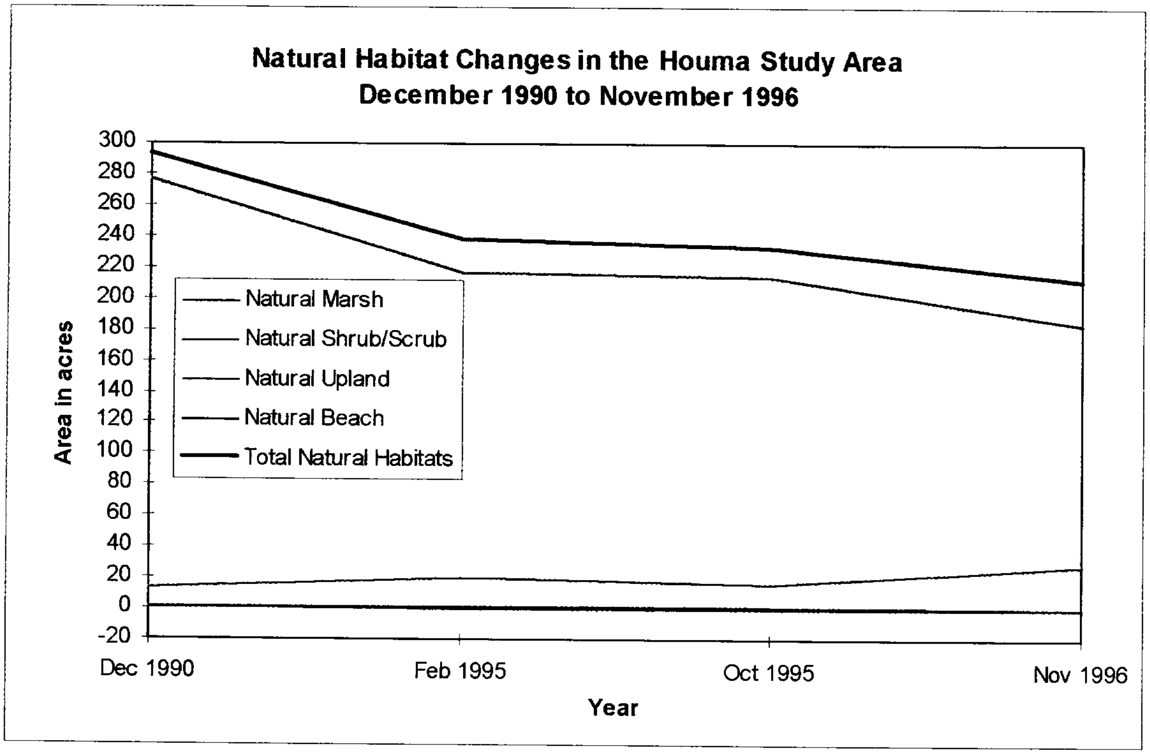
For the BUMP-made habitats, in decreasing order, there was a gain of +18.7 acres of marsh, +13.9 acres of shrub/scrub, and no change in beach. In terms of loss, bare land decreased by -19.9 acres and upland by -7.8 acres. The overall change in natural and man-made habitats was a decrease of -73.7 acres.

Figure 16 shows a time series of habitat changes along the Houma Navigation Canal - Bay Chaland BUMP study area. Figure 16A graphs the natural habitat changes over time. Natural marsh degradation and erosion dominates the processes affecting the natural habitat class. Figure 16B graphs man-made habitats. In terms of the beneficial use process, the greatest areas of new habitat creation include man-made marsh (+18.7 acres), and shrub/scrub (+13.5 acres) as indicated by the most recent inventory in November 1996 (Table 6).

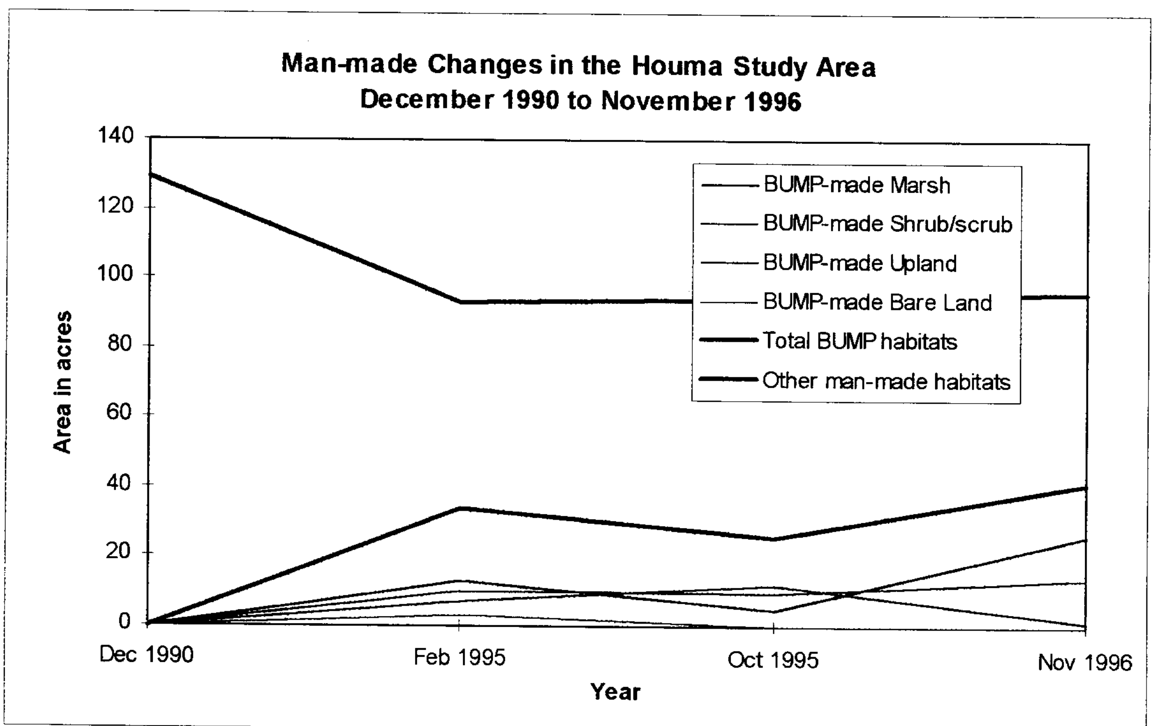
TABLE 6
Houma Navigation Canal - Bay Chaland
Cumulative Change in Total Acres of each Habitat
Between December 1990, February 1995, October 1995, and 1996

HABITAT	Dec 1990-Feb 1995[1]	Feb 1995-Oct 1995[1]	Oct 1995-Nov 1996[1]	Dec 1990-Nov 1996[1]
Natural Marsh	-64.8	+2.4	-23.8	-87.27
Natural Upland	+8.2	-3.8	+10.8	+15.2
Natural Shrub/Scrub	-0.1	+1.1	-1.8	-0.8
Natural Beach	-4.0	-0.1	-0.1	-4.2
Natural Bare Land	--	--	--	--
Total Natural Habitats	-60.7	-0.4	-14.9	-76.0
Other Man-made Marsh	+1.1	-8.0	+7.3	+0.4
Other Man-made Upland	-65.6	+3.6	+3.8	-58.2
Other Man-made Shrub/Scrub	+61.8	-0.6	-5.9	+55.3
Other Man-made Bare Land	--	--	--	--
Other Man-made Beach	--	--	+0.3	+0.3
Total Non-BUMP Man-made	-2.7	-5.0	+5.5	-2.2
BUMP Man-made Marsh	+13.2	-8.6	+14.1	+18.7
BUMP Man-made Upland	-0.5	+4.5	-11.8	-7.8
BUMP Man-made Shrub/Scrub	+10.4	-1.1	+4.2	+13.5
BUMP Man-made Bare Land	-16.9	-3.0	--	-19.9
BUMP Man-made Beach	--	--	--	--
Total BUMP Man-made Habitats	+6.2	-8.2	+6.5	+4.5
HABITAT TOTAL	-57.2	-13.6	-2.9	-73.7

[1] in acres



A



B

Figure 16. Time series showing the changes in total area of each habitat in the Houma Navigation Canal BUMP study area between December 1990 and November 1996. A) natural habitat changes. B) Man-made habitat changes.

CONCLUSIONS

1. The beneficial use of dredged material at the HNC navigation channel has been successful in nourishing and sustaining the marsh habitat.

2. The beneficial use of dredged material has created +4.5 acres of man-made habitats between 1990 and 1996. In contrast, the natural habitats in the study area have decreased by -76 acres. The resultant total decrease in area of the HNC area is -73.7 acres. This decrease in area is a result of erosion and subsidence. Over +18.7 acres of marsh have been created since 1990, which accounts for 58% of the new habitats created by beneficial use.

3. The field surveys indicated that the marshes created consist of salt marsh species and should be classed as salt marshes. The field surveys also documented that the optimum elevation for marsh development is less than 3 feet msl (3.78 feet Mean Low Gulf).

4. The habitat inventory documented a change from a study area primarily dominated by natural habitats in 1990 to both man-made and natural habitats in 1996. In 1990, the study area contained 423.0 acres of which 69% was natural and 31% was man-made. In 1996, the study area contained 349.3 acres of which 62% was natural and 38% was man-made.

5. The habitat change analysis indicated that +18.7 acres of man-made marsh was created through the beneficial use of dredged material. Other significant habitat changes due to beneficial use include the creation of +13.5 acres of shrub/scrub.

APPENDIX 7A
LIST OF VEGETATIVE SPECIES
OF THE HOUMA NAVIGATION CANAL - BAY CHALAND
STUDY AREA

LIST OF VEGETATIVE SPECIES
IN THE HOUMA NAVIGATION CANAL - BAY CHALAND STUDY AREA

An alphabetical list of observed and collected plant species follows. This list is not complete, but is meant to establish vegetative character and indicate dominant species observed. The list includes the year of observation, species name, alternate scientific names, common names, and general habitat description for each plant. The habitat information was taken from the Manual of the Vascular Flora of the Carolinas or The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts.

Baccharis halimifolia L. . . . . Groundselbush
  shrub; elevated sites in fresh to saline marshes

Borrichia frutescens (L.) . . . . sea ox-eye
  rhizomatous shrub; brackish marsh or upper zones of salt marsh

Distichlis spicata (L.) Greene . . . . salt grass
  rhizomatous perennial; brackish marshes and flats

Heliotropium curassavicum L. . . . . seaside heliotrope
  annual succulent; seashores and borders of fresh to saline marsh

Iva frutescens L. . . . . marsh elder
  shrub; brackish marshes, upper zones of salt marsh

Solidago sempervirens L. . . . . seaside goldenrod
  perennial; brackish marsh or saline sand

Spartina alterniflora Loisel. . . . . oyster grass
  rhizomatous perennial; salt and brackish marshes

U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe

Base Year 1985 through Fiscal Year 1996

Shea Penland, Karen A. Westphal, Qiang Tao, Chris Zganjar, Paul Connor, and Jamie Phillippe
Louisiana State University - Coastal Studies Institute
Baton Rouge, LA 70803

and

Linda Mathies, Beth Nord, and John Flanagan
Operations Division - Technical Support Branch (CELMN-OD-T)
U.S. Army Corps of Engineers - New Orleans District
New Orleans, LA 70160-0267

Baton Rouge, Louisiana
1997

TABLE OF CONTENTS

INTRODUCTION 8-1

DREDGED MATERIAL DISPOSAL HISTORY 8-4

FIELD SURVEY RESULTS 8-6
Methodology 8-6
Elevation Profile Surveys 8-6
Vegetation Surveys 8-7
Profile 8-8
Vegetative Character 8-11
General Description 8-11
Vegetative Community Types in the Atchafalaya Lower River 8-11

GIS ANALYSIS RESULTS 8-12
Shoreline Changes: 1985-1996 8-12
Habitat Inventory 8-17
Habitat Change 8-23

CONCLUSIONS 8-29

REFERENCES 8-29

APPENDIX 8A 8A-1

LIST OF FIGURES

Figure 1. The location of the Lower Atchafalaya Horseshoe BUMP study area in Louisiana. 8-1

Figure 2. The Lower Atchafalaya River Horseshoe BUMP study area showing the minimum coverage of the aerial photo-mosaic and limits of the area digitized. 8-3

Figure 3. Dredged material disposal history and USACE-NOD disposal areas for the Lower Atchafalaya River Horseshoe navigation channel through 1996. 8-5

Figure 4. Location of Lower Atchafalaya River Horseshoe BUMP study site, and the tide gage used to reference the elevation data. 8-7

Figure 5. Photograph of fresh marsh along the transect at the Lower Atchafalaya River Horseshoe BUMP study area taken on October 29, 1996. 8-9

Figure 6. Photograph of vine-terrace along the transect at the Lower Atchafalaya River Horseshoe BUMP study area taken on October 29, 1996. 8-9

Figure 7. Elevation profile of the Lower Atchafalaya River Horseshoe BUMP study site with vegetation data illustrated. 8-10

Figure 8. Graph of the area of the Lower Atchafalaya River/Horseshoe BUMP study area over time, with and without the placement of dredged material. 8-13

Figure 9. Shoreline changes of the Lower Atchafalaya Horseshoe BUMP study area between December 1985 and November 1996. 8-14

Figure 10. Shoreline changes of the Lower Atchafalaya River Horseshoe BUMP study area between December 1985 and October 1995. 8-15

Figure 11. Shoreline changes of the Lower Atchafalaya River Horseshoe BUMP study area between October 1995 and November 1996. 8-16

Figure 12. Habitat inventory map of the Lower Atchafalaya River Horseshoe BUMP study area in December 1985. 8-18

Figure 13. Habitat inventory map of the Lower Atchafalaya River Horseshoe BUMP study area in October 1995. 8-20

Figure 14. Habitat inventory map of the Lower Atchafalaya River Horseshoe BUMP study area in November 1996. 8-22

Figure 15. Map of the Lower Atchafalaya River Horseshoe BUMP study area showing the new habitats that developed between December 1985 and November 1996. . 8-24

Figure 16. Time series showing the changes in total area of each habitat in the Lower Atchafalaya River/ Horseshoe BUMP study area between 1985, 1995 and 1996. A) natural habitat changes. B) other man-made habitat changes C) BUMP habitat changes. 8-26

Figure 17. Map of the Lower Atchafalaya River Horseshoe BUMP study area showing the new habitats that developed between December 1985 and November 1995. . 8-27

Figure 18. Map of the Lower Atchafalaya River Horseshoe BUMP study area showing the new habitats that developed between November 1995 and November 1996. . 8-28

LIST OF TABLES

TABLE 2 December 1985 Habitat Inventory of the Lower Atchafalaya River Horseshoe . 8-17

TABLE 3 October 1995 Habitat Inventory of the Lower Atchafalaya River Horseshoe 8-19

TABLE 4 November 1996 Habitat Inventory of the Lower Atchafalaya 8-21

TABLE 5 Changes in Total Acres of Each Habitat in the Lower Atchafalaya River Horseshoe between December 1985 and November 1996 8-25

INTRODUCTION

The Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe (Horseshoe) navigation channel is located 20 miles south of Morgan City, Louisiana (Figure 1). This area is dominated by the riverine influence of the Atchafalaya River. The U.S. Army Corps of Engineers - New Orleans District (USACE-NOD) maintains this navigation channel through the prograding Atchafalaya delta complex.

The Beneficial Use Monitoring Program (BUMP) at Louisiana State University - Coastal Studies Institute (LSU-CSI) is documenting the disposal and beneficial use of dredged material using aerial photography, geographical information system (GIS) analysis, and field surveys through the sponsorship of the USACE-NOD. BUMP results are provided in map series, annual reports, and scientific literature.

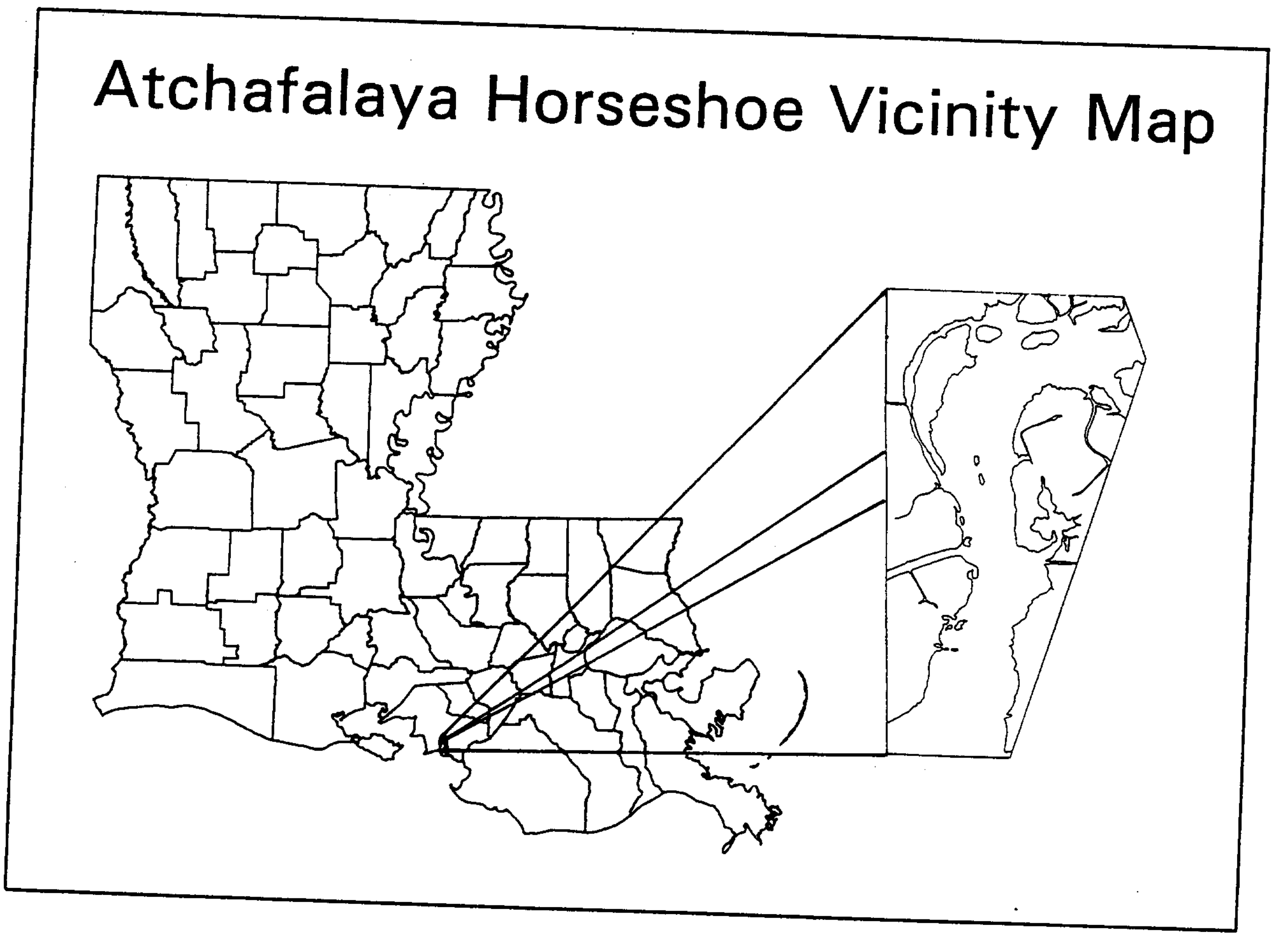


Figure 1. The location of the Lower Atchafalaya Horseshoe BUMP study area in Louisiana.

In this report, LSU presents the first results of the BUMP analysis at the Lower Atchafalaya River Horseshoe navigation channel. This is the eighth part of the nine part Beneficial Use of dredged material Monitoring Program (BUMP), 1995 Final Report, representing monitoring results through the USACE-NOD Fiscal Year 1996. The nine parts are:

- Part 1: Introduction and Methodology
- Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
- Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
- Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
- Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
- Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass
- Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Channel, Louisiana - Bay Chaland
- Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe
- Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Using aerial photography, LSU classified the natural and man-made habitats in the study area for December 1985, October 1995, and November 1996 including the Fiscal Year 1996 (FY96) maintenance event. Through the GIS analysis, these areas were calculated and changes documented between 1985 and 1996. Field surveys were conducted in October 1996 on a peninsula created/constructed through the beneficial use of the dredged material removed during routine maintenance operations in 1995. Habitats were ground truthed and survey transects were established to document vegetation species, stacking elevations, and compaction/subsidence. Figure 2 shows the area of minimum aerial photo-mosaic coverage and the limit of the digitized area.

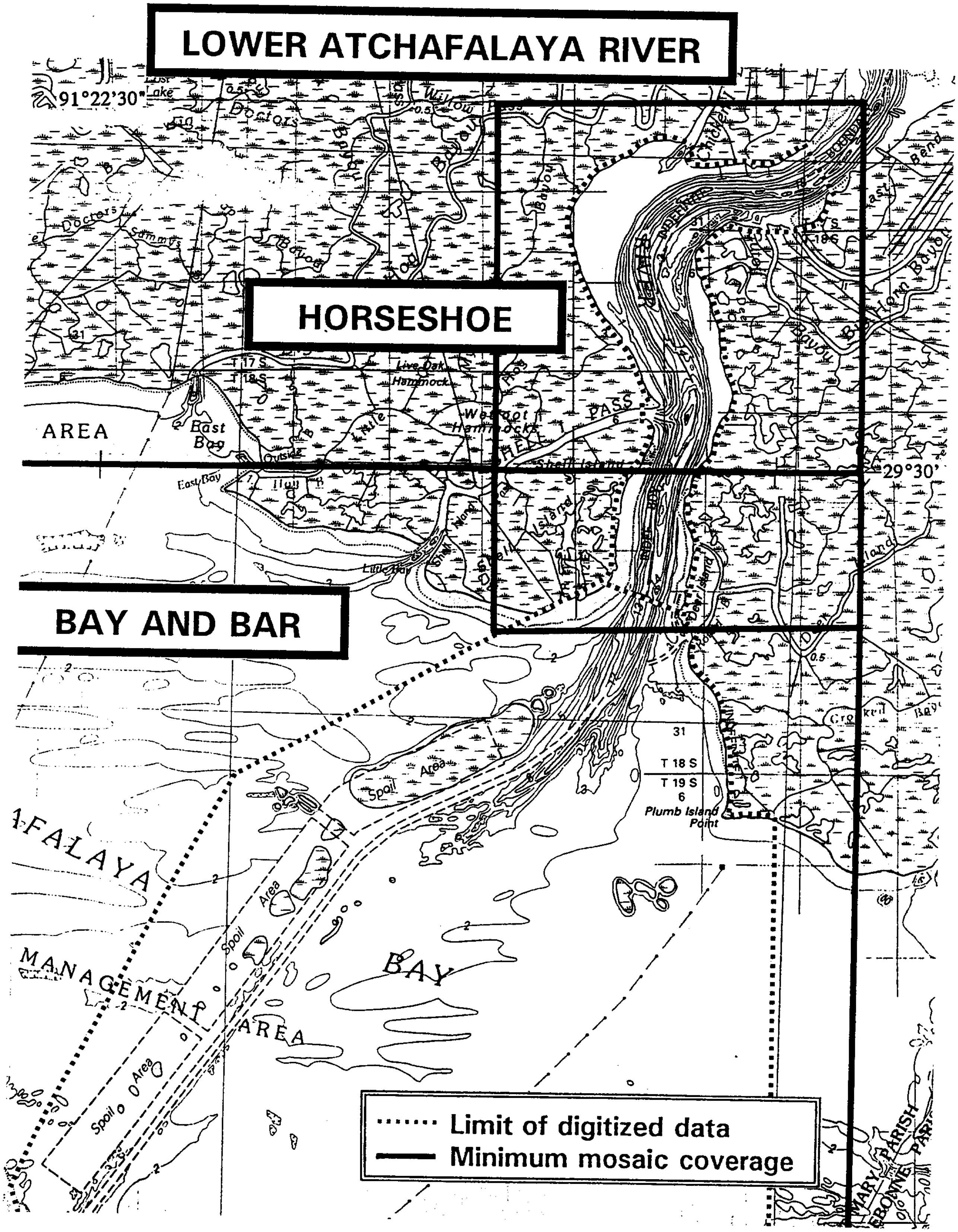


Figure 2. The Lower Atchafalaya River Horseshoe BUMP study area showing the minimum coverage of the aerial photo-mosaic and limits of the area digitized.

DREDGED MATERIAL DISPOSAL HISTORY

The Rivers and Harbors Act of 25 June 1910 authorized the USACE-NOD to construct and maintain a navigation channel through the Atchafalaya River from Morgan City to the Gulf of Mexico with project dimensions 20 feet deep, 200 feet wide and 15.75 miles long from the 20 foot contour in the Atchafalaya Bay, approximately 4 miles beyond the mouth of the Atchafalaya River, to the 20 foot contour in the Gulf of Mexico. Traffic sufficient to warrant maintenance of the authorized navigation channel to full project dimensions did not immediately develop. The channel was progressively enlarged during maintenance events from 10 by 100-feet in 1939 to 20 by 200-feet in 1974.

The Rivers and Harbors Act of 1968 authorized construction and maintenance of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana project which provided an increase in channel width to 400 feet of the navigation channel in Atchafalaya River - Horseshoe from the junction of Avoca Island Cutoff Bayou channel to the Atchafalaya Bay. Construction of the channel in the bay and Gulf was initiated in April, 1974 and was completed in December of the same year. This area has been dredged annually since 1989.

Specific disposal information at the Atchafalaya River - Horseshoe Cut prior to FY1995 was unavailable at the time of this report. It is likely that dredged material was placed unconfined in open water on either side of the navigation channel. Figure 3 was compiled from aerial photographic data and the USACE-NOD FY95 *as-builts*.

LOWER ATCHAFALAYA RIVER HORSESHOE
DREDGING DISPOSAL HISTORY

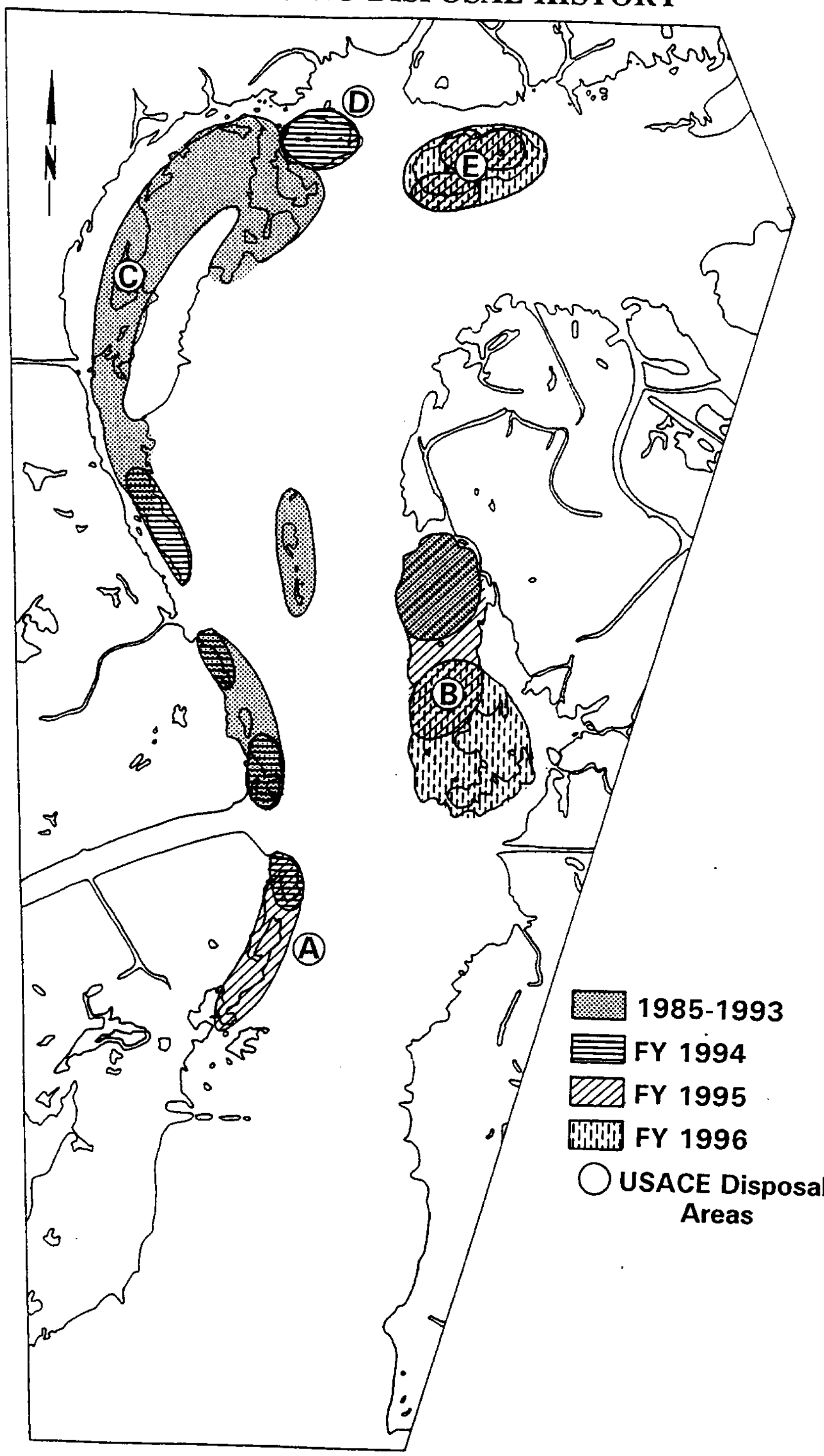


Figure 3. Dredged material disposal history and USACE-NOD disposal areas for the Lower Atchafalaya River Horseshoe navigation channel through 1996. 1995 data from USACE -NOD *as-builts*, pre-1995 data from aerial photography.

FIELD SURVEY RESULTS

Methodology

Elevation Profile Surveys

The peninsula on the east side of the Lower Atchafalaya River Horseshoe, Disposal Area B, was selected as the BUMP monitoring site by the USACE-NOD (Figure 4). This peninsula was constructed during the FY1992, FY95 and FY96 maintenance events.

The collection of the survey profile was made in two phases. Phase-I involved assessing the characteristics of each site to determine the most applicable position to setup a long-term monitoring program that would best document habitat evolution. This was accomplished using vertical aerial photography, reviewing dredging schedules and history, ground truthing each site, and defining varying vegetation and site morphology. Based on these factors, two stakes were positioned across the Horseshoe BUMP study area oriented to traverse habitats near perpendicular to the river shoreline. Permanent 1-inch diameter by 6-foot galvanized stakes were driven approximately 3.5-feet into the ground and secured with concrete. The stakes were positioned 40-feet apart and defined spatially using a Global Positioning System (GPS).

Phase-II involved the actual collection of profile datum. In October 1996, the profile survey was conducted along the transect defined by the stakes placed during phase-I. Survey datum were collected using a Topcon GTS-300$_{DPG}$ Total-Station, tri-prism, and TDS48 Data Collection System. The horizontal accuracy of the GTS-300 is 0.25 ft ± 0.0125 ft., and has a vertical accuracy of 0.45 ft ± 0.0125 ft. The maximum horizontal range with tri-prism is 3,525 ft. A Pathfinder Professional MC-5 global positioning system (GPS) device was used to record the horizontal positions of each stake, instrument location, and the position and exact orientation of each transect line. The transect datum collected were processed, referenced to the nearest tide gage, and entered into a graphic software program to produce topographic profiles (Figure 4).

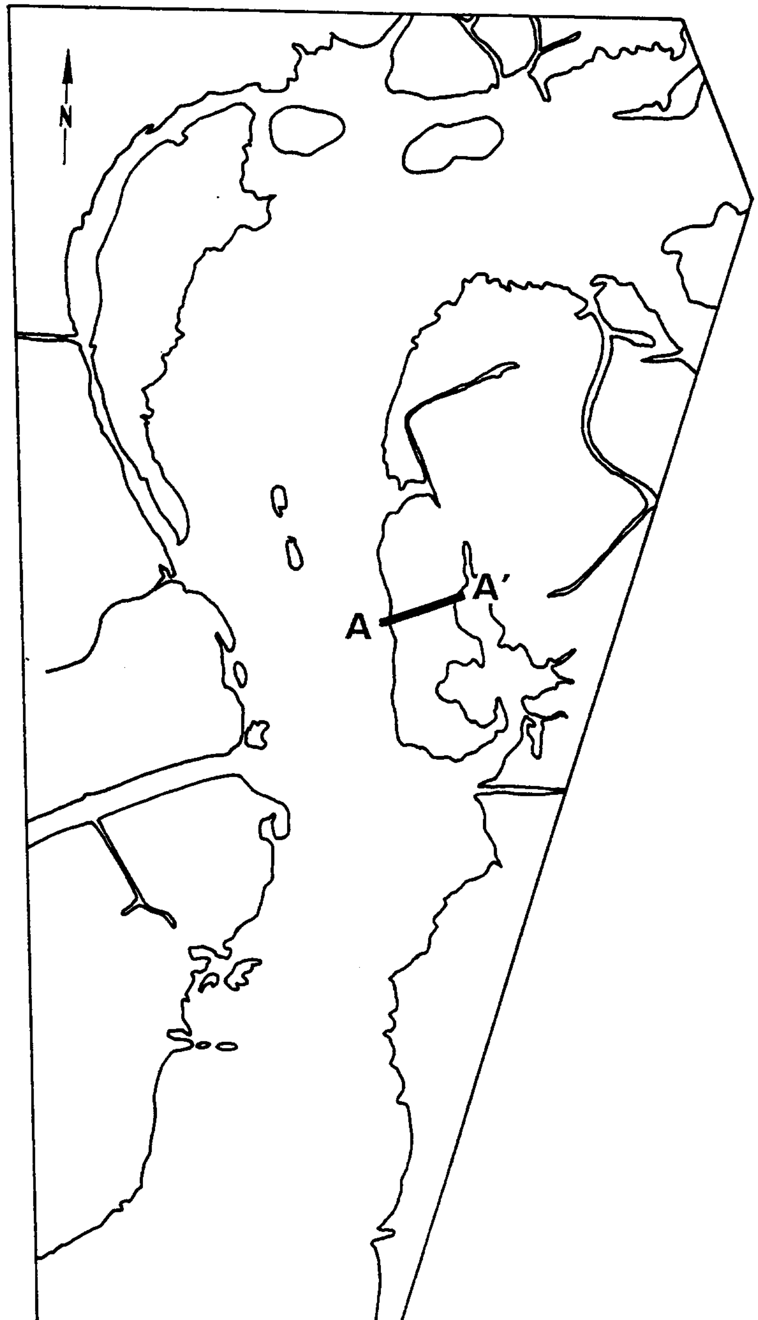


Figure 4. Location of the transect at the Lower Atchafalaya River Horseshoe BUMP study site.

Vegetation Surveys

Ground truthing for vegetative species composition and habitat verification of the Lower Atchafalaya River Horseshoe BUMP study site was done in October 1996. Species composition was determined within an approximate six- foot swath along the profile, and boundaries between vegetative communities were entered as points on the elevation profile. No submerged aquatic species were considered for this report. Plants were identified in the field with only representative specimens taken for confirmation by taxonomic keys and/or verification by the LSU Department of Plant Biology. The better specimens, and uncommon specimens were entered into the LSU herbarium collection; all others were archived by the author. The percent composition of each species was visually estimated in order to determine the relative abundance and dominance of species for habitat determinations. These percentages were not intended to provide scientific ratios or statistics. The *list of vegetative species* was compiled of all species observed and/or collected along the study and includes habitat preferences of each (Appendix 8A). This list is not complete; it reflects only those species that were readily observed and identified during the profiling period. Some plants can only be identified during a short flowering period which may not have occurred at the time of the profile, and therefore can not be included in the list other than by a broad classification

Profile

The field monitoring area was a wide peninsula created by dredged material deposition on the east side of the Lower Atchafalaya River Horseshoe channel (Figure 4). Because the FY96 deposition was in progress during the time of the survey, the survey transect was established across material that was placed before and during FY95. The profile elevations were taken during a period of high water for the Atchafalaya delta. The sediment deposited is reported in the FY95 *as-built* as 90% silt and 10% sand.

The 1996 transect was established with two permanent 1-inch diameter by 6-foot galvanized stakes, set 40-feet apart, driven approximately 3.5 feet into the ground and secured with concrete. The far side of the site was colonized by 15-foot willow trees and the transect had to be placed so that the survey instrument had line of sight. One stake was placed to the east of a vehicle track used by the dredging crews to transport earth moving equipment to the site currently under deposition. The second stake was placed along the transect before the willow tree area. This transect traversed fresh marsh, willow tree thicket, upland vine-terrace, bare and beach areas (Figure 5 and 6).

One topographic profile for Horseshoe was constructed from the data collected in reference to the tide gage at Point Au Fer, Atchafalaya, Louisiana (29°20' N / 91°21' W). The mean diurnal tidal range for tide gage location is published as 2.1 feet, but this area is influenced more by the Atchafalaya River flood stage. The profile was 1450 feet in length with a maximum relief of 3.97 feet and average relief of 3.97 feet (Figure 7).

Figure 5. Photograph of fresh marsh along the transect at the Lower Atchafalaya River Horseshoe BUMP study area taken on October 29, 1996.

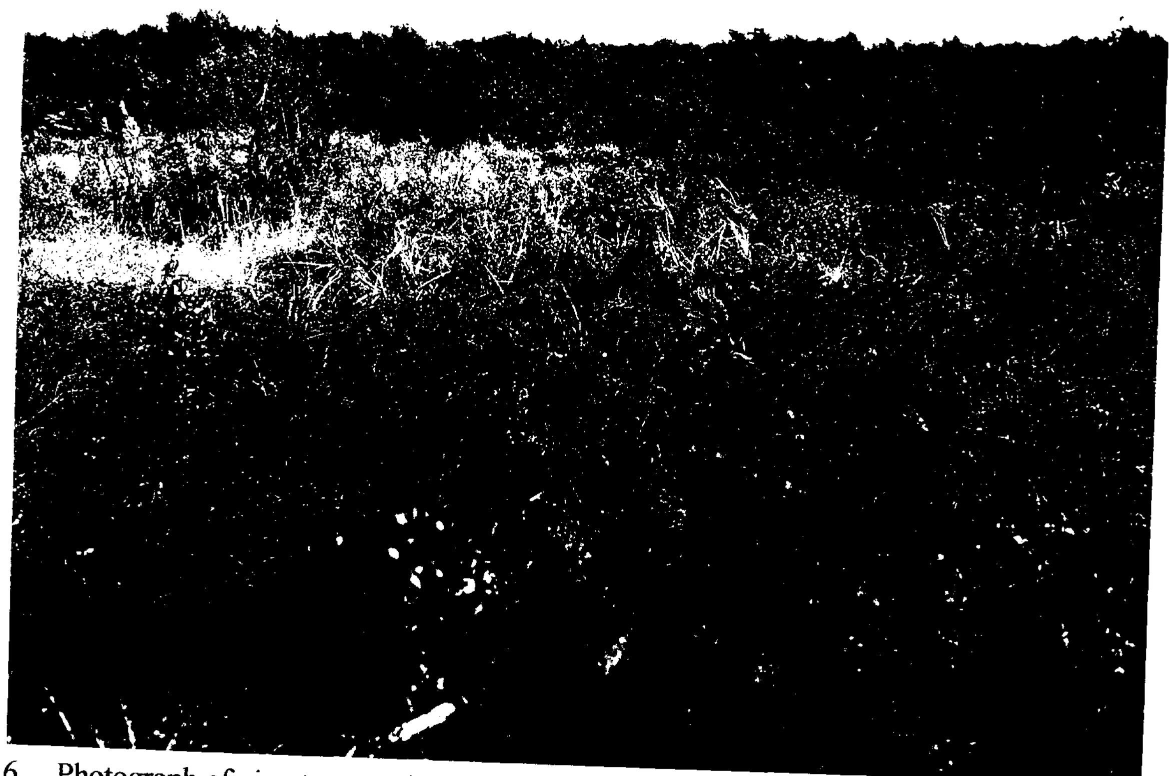


Figure 6. Photograph of vine-terrace along the transect at the Lower Atchafalaya River Horseshoe BUMP study area taken on October 29, 1996.

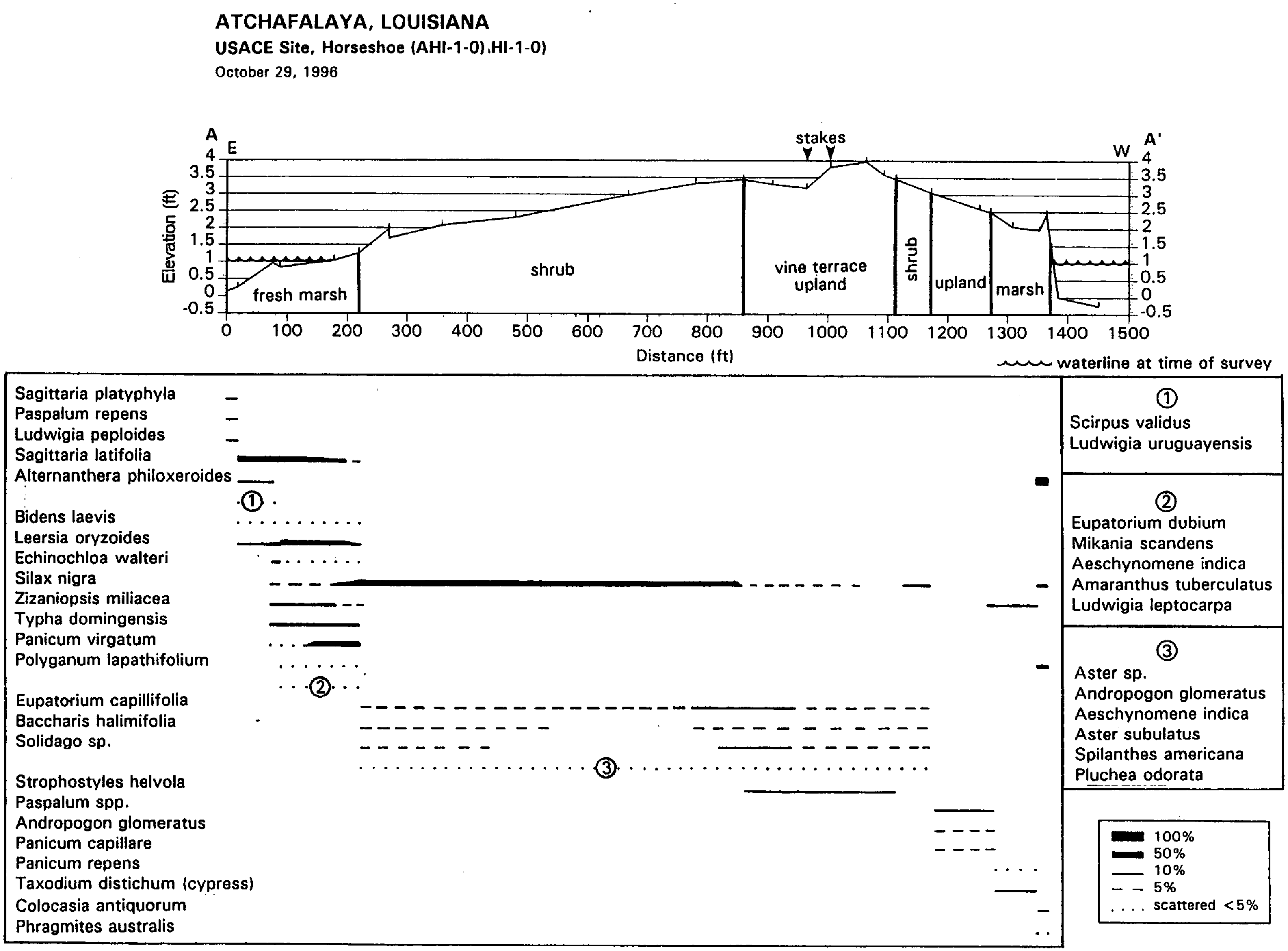


Figure 7. Elevation profile of the Lower Atchafalaya River Horseshoe BUMP study site with vegetation data illustrated.

Vegetative Character

General Description

The Atchafalaya River supports a freshwater vegetation system. Within the BUMP study area, there is predominately fresh marsh, shrub and forested wetland communities dominated by black willow, and upland/grassland habitats. The lower river area is exposed to the daily tides as well as to elevated water levels during high river conditions. Source material for colonization is predominantly from the extensive Atchafalaya River swamp system that lies upstream from the dredged material disposal sites. Aeolian transport of some vegetative material could be expected from other nearby areas.

Vegetative Community Types in the Atchafalaya Lower River

Most of the plants observed within the study site at the Lower Atchafalaya River Horseshoe area are of riparian or wetland habits (See habitat descriptions in Appendix 8A). Other species are listed as occupying "disturbed" or "waste" places and are species that take advantage of newly created or exposed ground with rapid growth and can withstand some inundation by fresh water. These opportunistic species will occupy a new area quickly, but most will eventually be replaced by plants more suited to long term survival at this specific habitat.

Marsh species within the study site occurred most commonly at an elevation below 2 feet MSL. Dominant species of the low fresh marsh included duck-potato (*Sagittaria latifolia, Sagittaria platyphyla*), *Paspalum repens*, alligator weed (*Alternanthera philoxeroides*), and flowering *Ludwigia* spp. Significant species of the high marsh were wild rice (*Zizaniopsis miliacea*), cattails (*Typha latifolia*), and Walter's millet (*Echinochloa walterii*). Numerous young willow trees (*Salix nigra*) and a few cypress seedlings (*Taxodium distichum*) were present, scattered in many areas of the marsh, but were too small to be considered a forested wetland habitat. Water hyacinth (*Eichhornia crassipes)* was found along the shore, rafted against the windward side and stranded thickly by a previous high water event.

Upland areas within the study site were represented by grasslands, herbaceous meadows, vine terraces, and potential shrub/scrub. *Panicum capillare*, *Andropogon glomeratus*, and *Paspalum* spp. tend to be the most common grass species, with *Aster* spp, *Eupatorium capillifolium*, *Solidago* sp., as common herbaceous plants, with a profusion of *Strophostyles helvola* vines twining over all. Older deposits support additional species and the beginnings of shrub habitats.

Shrubs are defined for this study as woody plants under 20 feet tall, and shrub communities usually indicate older, more stable, elevated areas. In the Atchafalaya area, this is almost exclusively *Salix nigra* or black willow. Since *Salix* also forms a forested wetland habitat, shrub/scrub is not a good indicator of elevation in the delta, but does indicate stable areas. Young willows were profusely represented along the survey transect, scattered in many areas of the marsh, along low energy beaches, or within the grasslands. A few cypress seedlings (*Taxodium distichum*) were present in the upper marshes. *Baccharis halimifolia* was the only other shrub species found along the study profile.

GIS ANALYSIS RESULTS

Shoreline Changes: 1985-1996

Figure 8 graphs the spatial history of the Lower Atchafalaya River Horseshoe BUMP study area between December 1985 and November 1996 shown in Table 1 and illustrated in Figure 9. The Horseshoe study area in December 1985 was measured at 3104.1 acres. The study area in November 1996 was measured at 4034.1 acres. This is an area increase of 930 acres or an increase in area of 30 percent at a rate of 85.3 acres per year for this 10.9 year time period. The primary areas of progradation took place along the margins of the navigation channel due to the beneficial placement of dredged material.

Figure 10 shows the shoreline change history of the Horseshoe study area between December 1985 and November 1995. The total area of Horseshoe increased by +1092.0 acres at a rate of +110.3 acres per year for this 9.9 year period. The primary areas of progradation took place within USACE Disposal Areas A, B, C, D and E (Figure 4).

Figure 11 shows the shoreline change history of the Horseshoe study area between November 1995 and November 1996. The total area increased by +162.0 acres. The BUMP areas slightly increased by 86.3 acres. The majority of the loss occurred in the natural areas due to channels migrating and interior ponds enlarging. The primary areas of progradation took place within USACE Disposal Areas B and E (Figure 4).

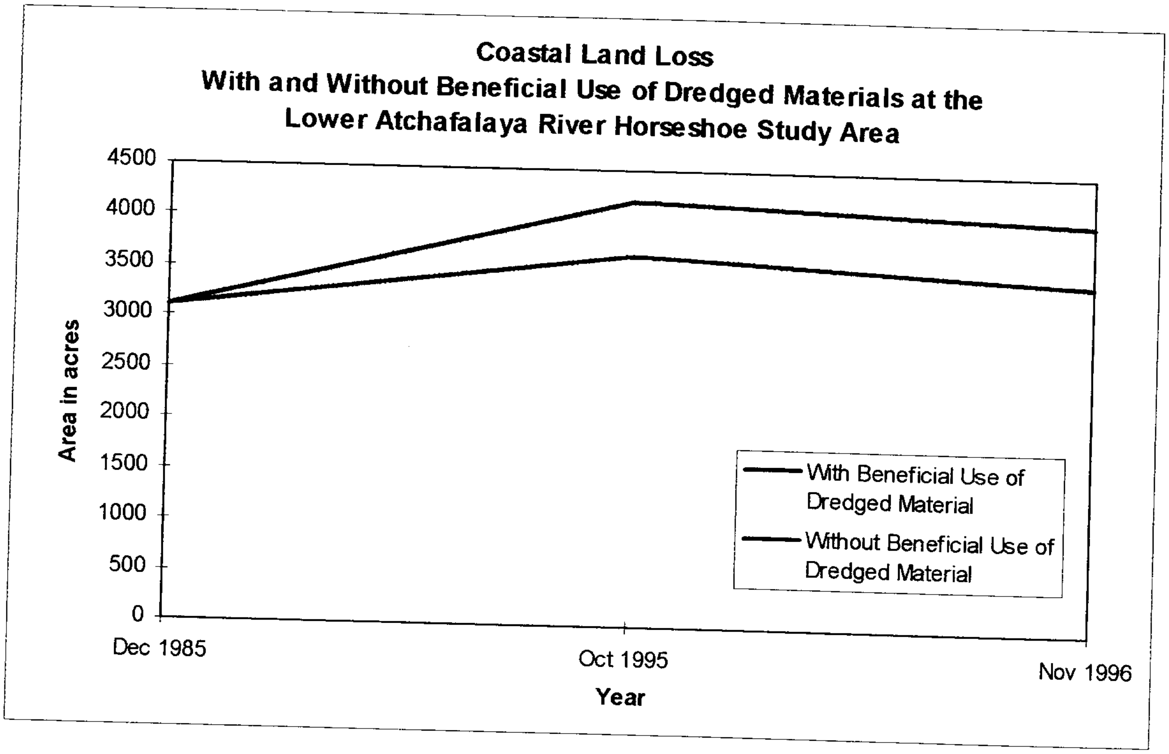
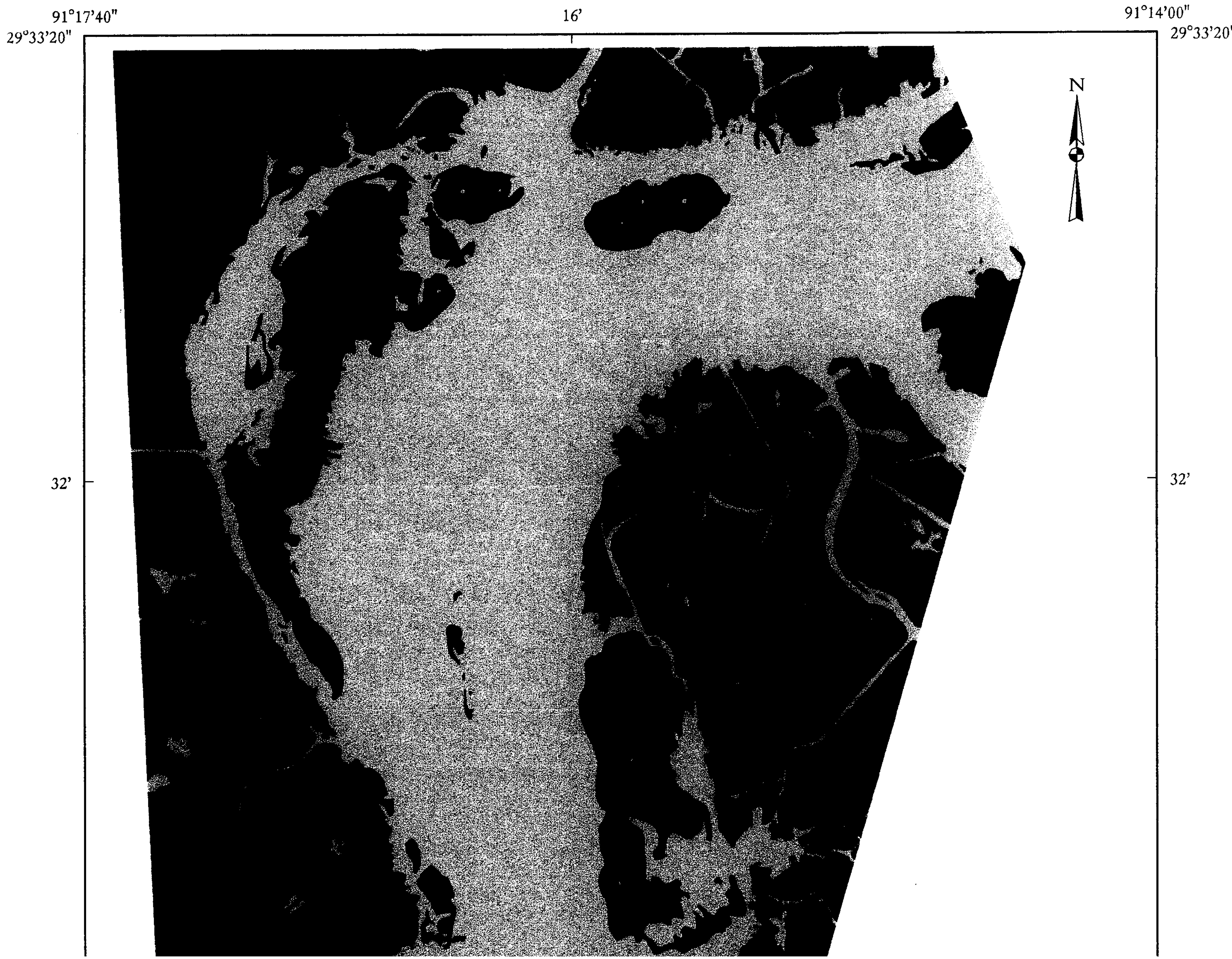


Figure 8. Graph of the area of the Lower Atchafalaya River Horseshoe BUMP study area over time, with and without the placement of dredged material.

TABLE 1
Atchafalaya/Horseshoe Area: 1985 - 1996

Area in Acres	Dec 1985	Oct 1995	Nov 1996
Natural Areas	2903.8	3444.3	3223.4
Other Man-made Areas	200.3	206.9	206.5
BUMP-made Areas	0	544.9	604.2
Total	3104.1	4196.1	4034.1



91°17'40"
16'
91°14'00"
29°33'20"
29°33'20"
32'
32'
N

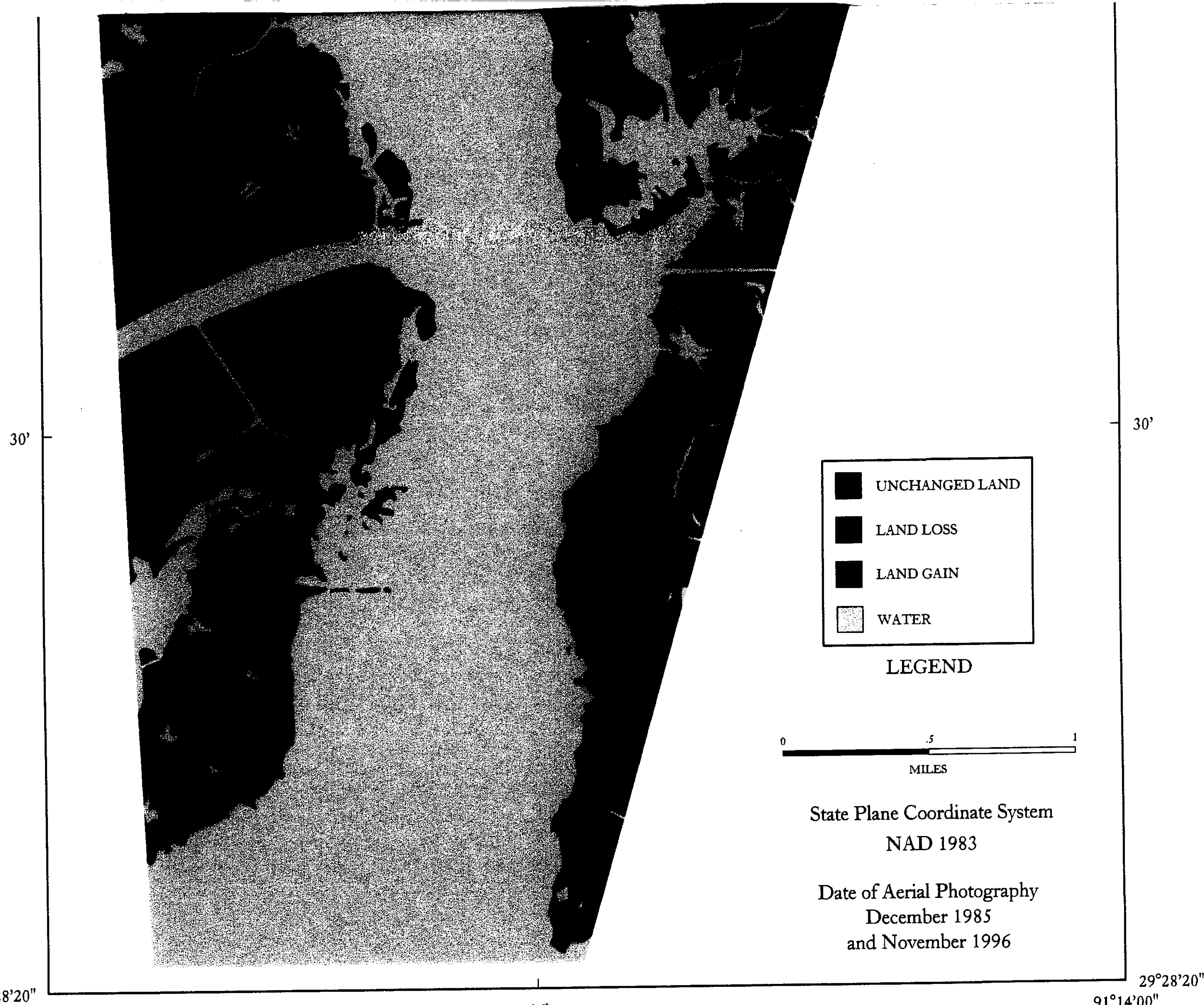


Figure 9. Shoreline changes of the Lower Atchafalaya Horseshoe BUMP study area between December 1985 and November 1996.

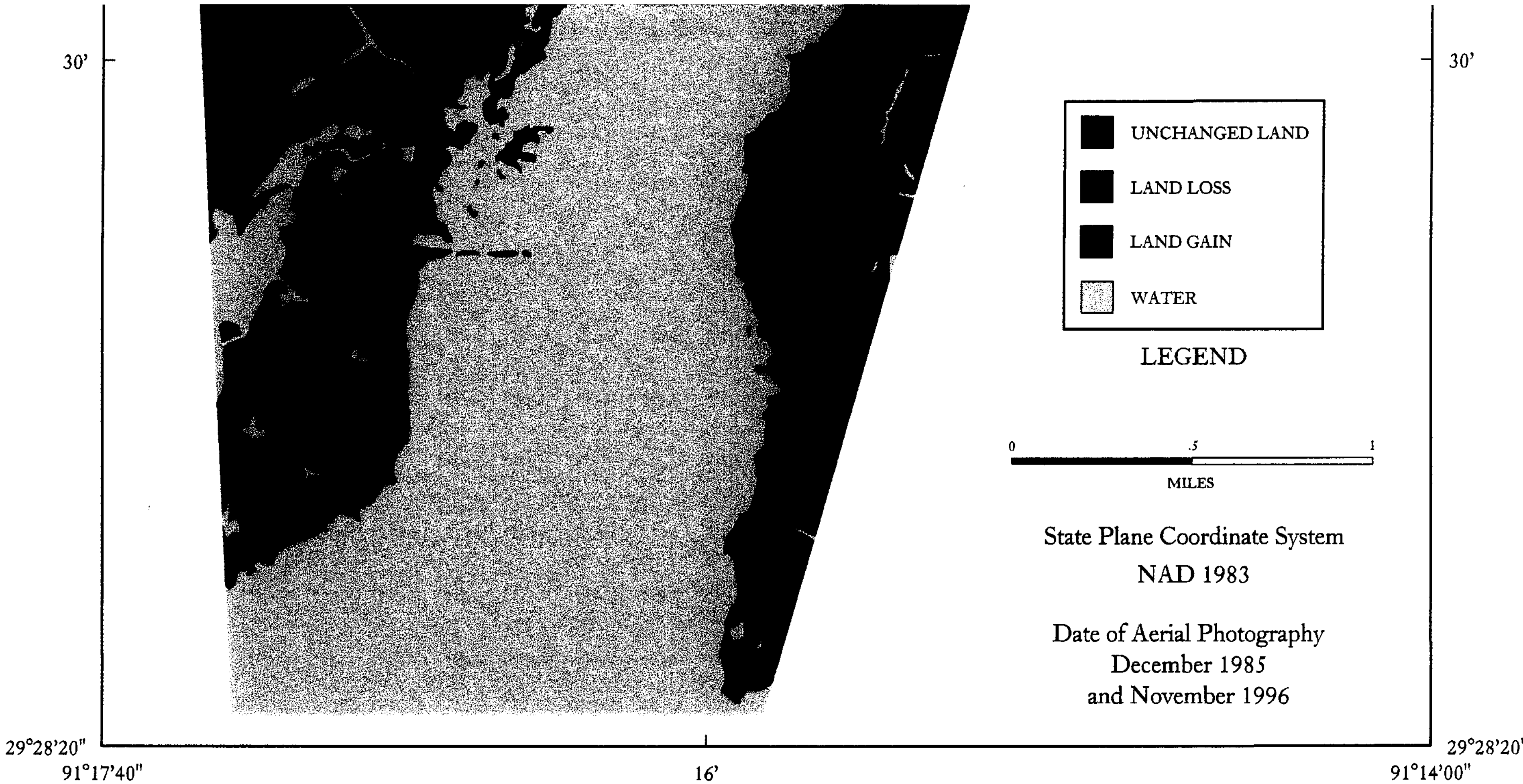
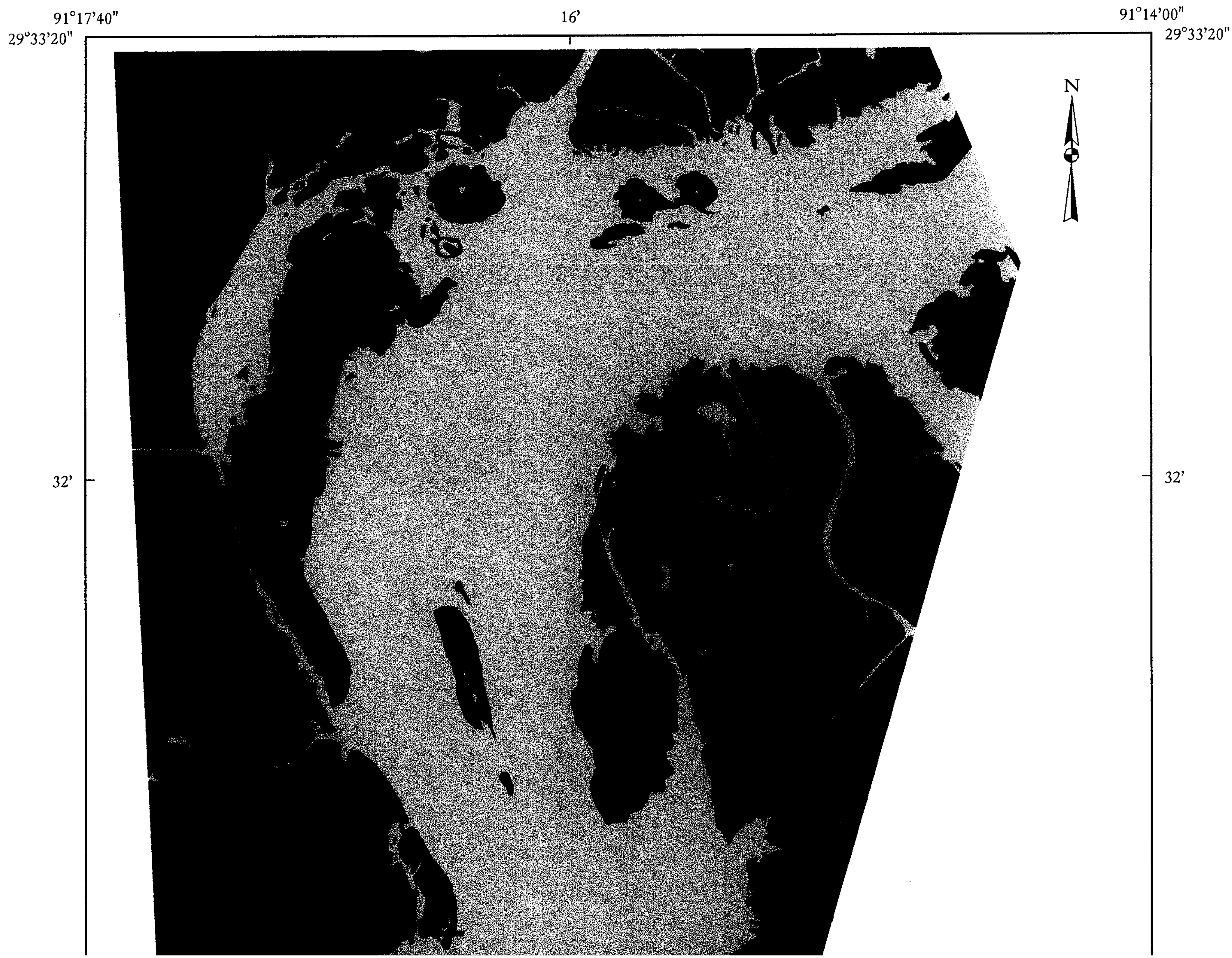
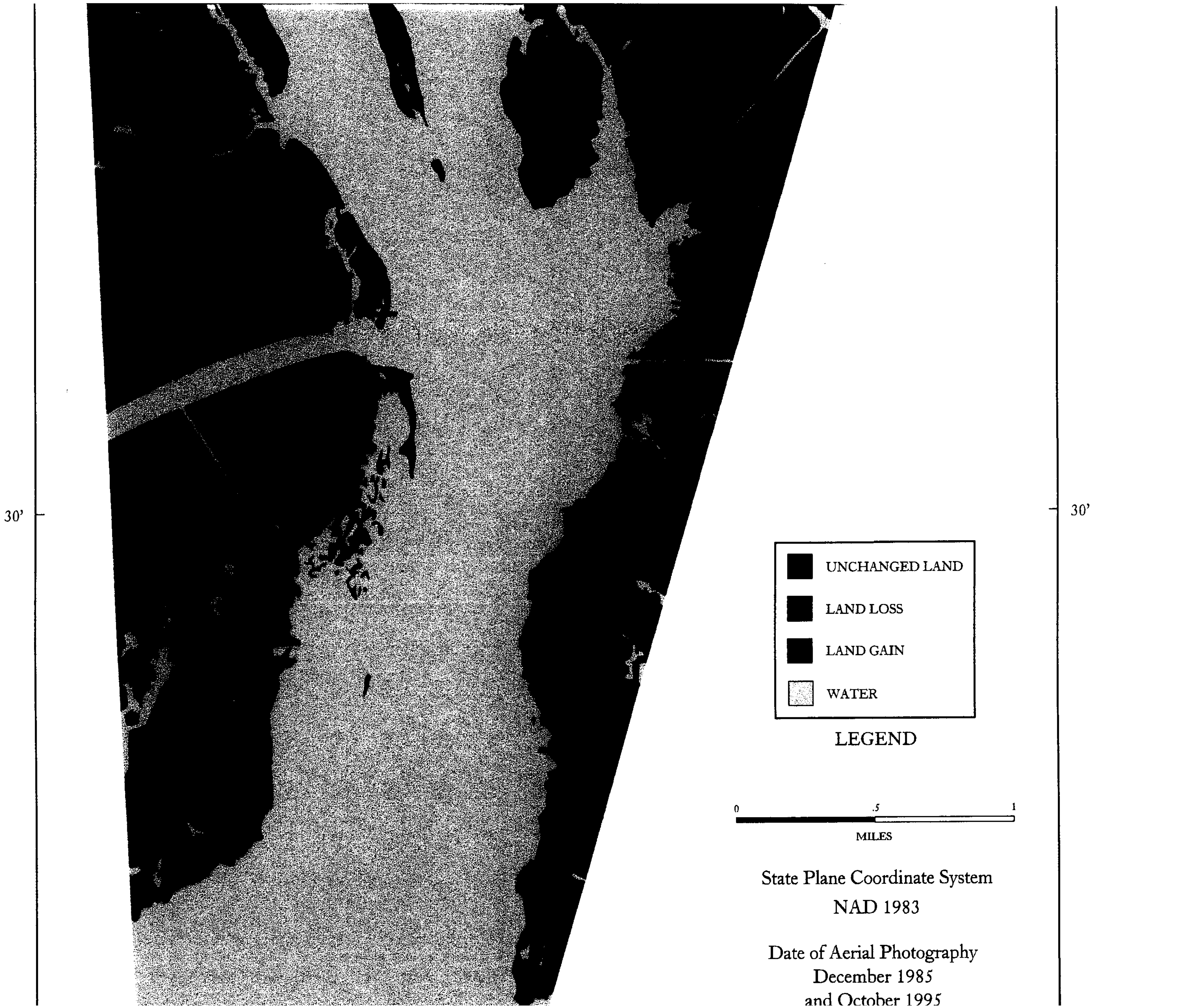


Figure 9. Shoreline changes of the Lower Atchafalaya Horseshoe BUMP study area between December 1985 and November 1996.



91°17'40"
29°33'20"
16'
91°14'00"
29°33'20"
N
32'
32'


30'
30'
UNCHANGED LAND
LAND LOSS
LAND GAIN
WATER
LEGEND
0
.5
1
MILES
State Plane Coordinate System
NAD 1983
Date of Aerial Photography
December 1985
and October 1995

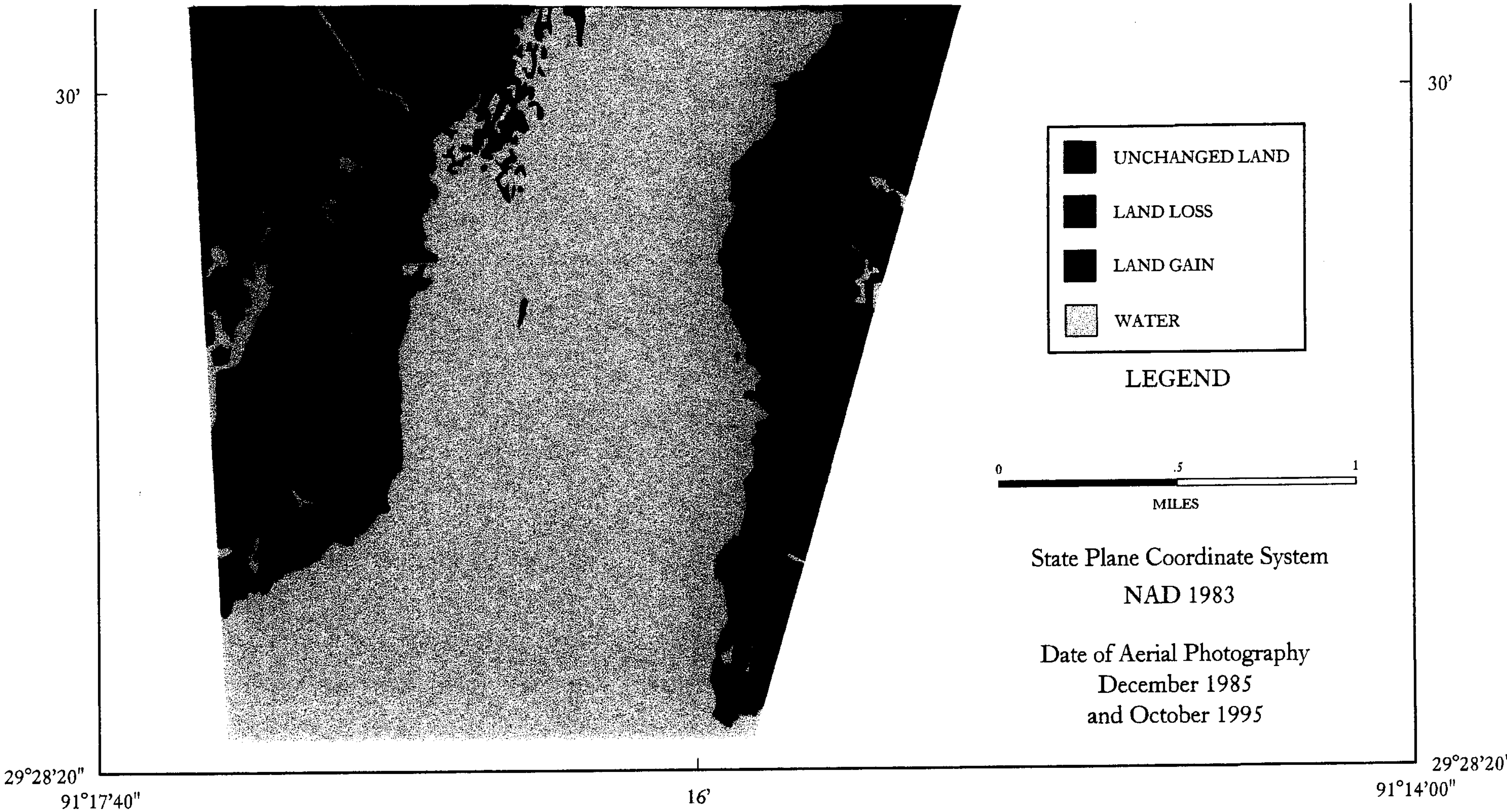
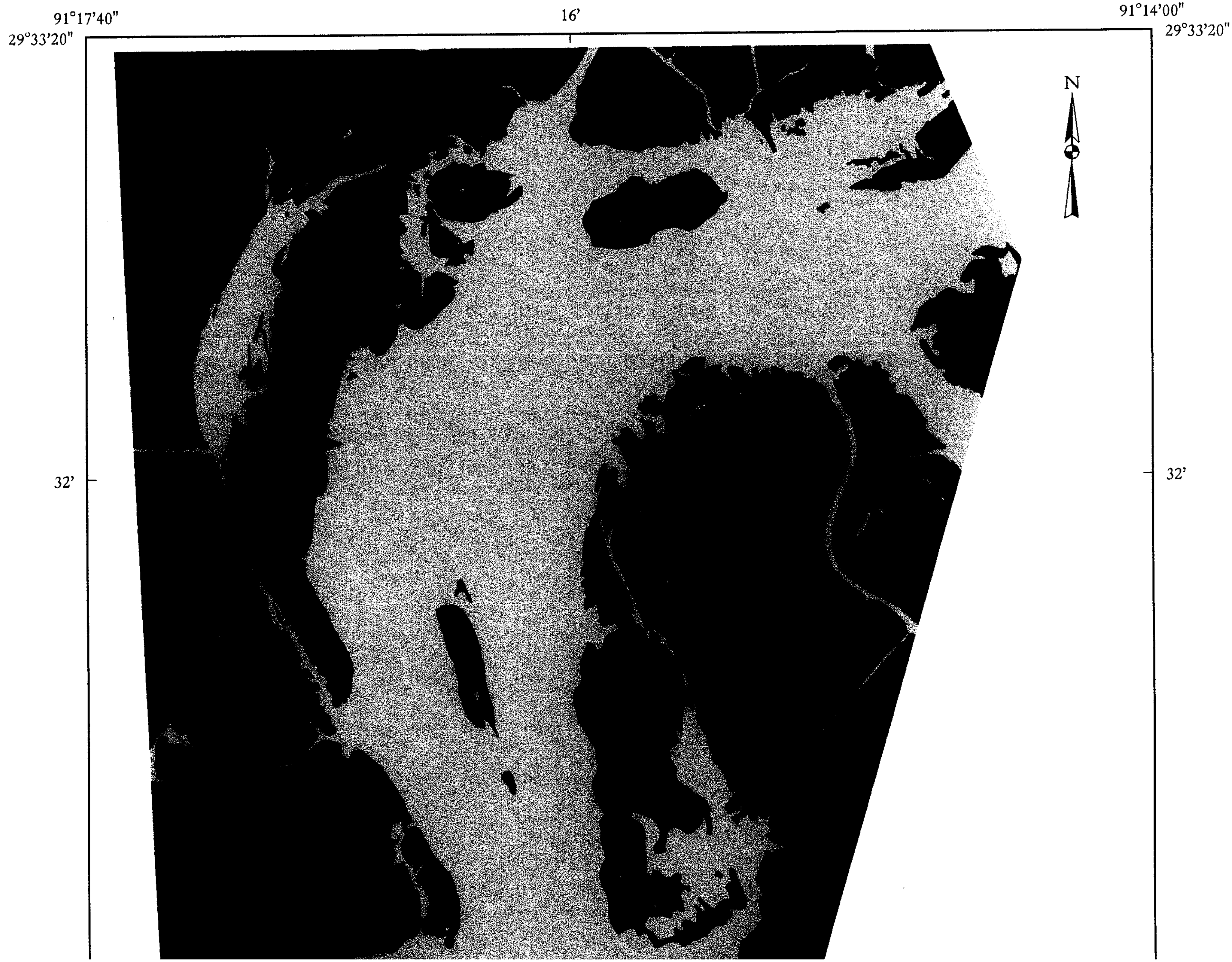
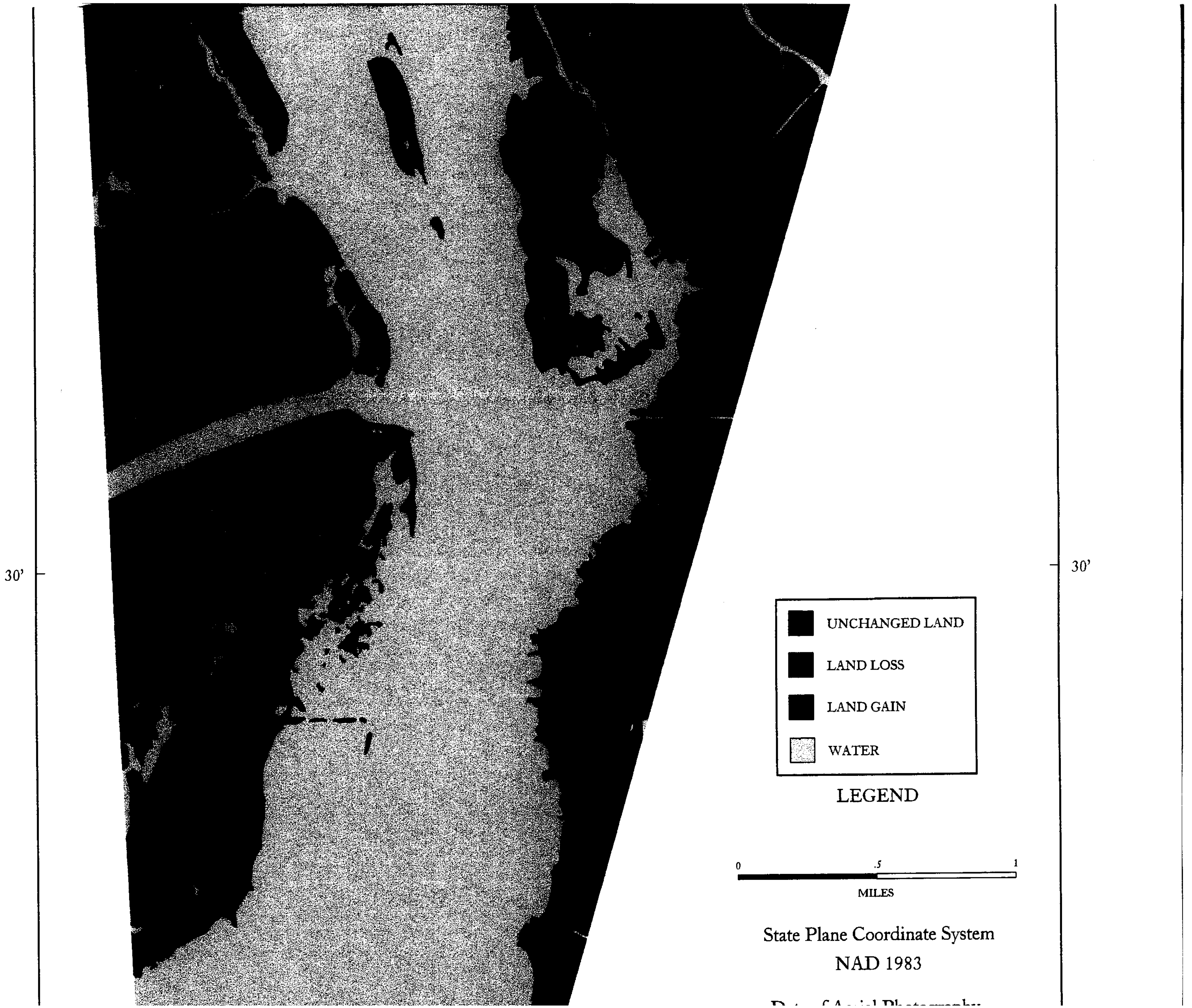


Figure 10. Shoreline changes of the Lower Atchafalaya River Horseshoe BUMP study area between December 1985 and October 1995.



91°17'40"
16'
91°14'00"
29°33'20"
29°33'20"
N
32'
32'


30'
30'
UNCHANGED LAND
LAND LOSS
LAND GAIN
WATER
LEGEND
0
.5
1
MILES
State Plane Coordinate System
NAD 1983

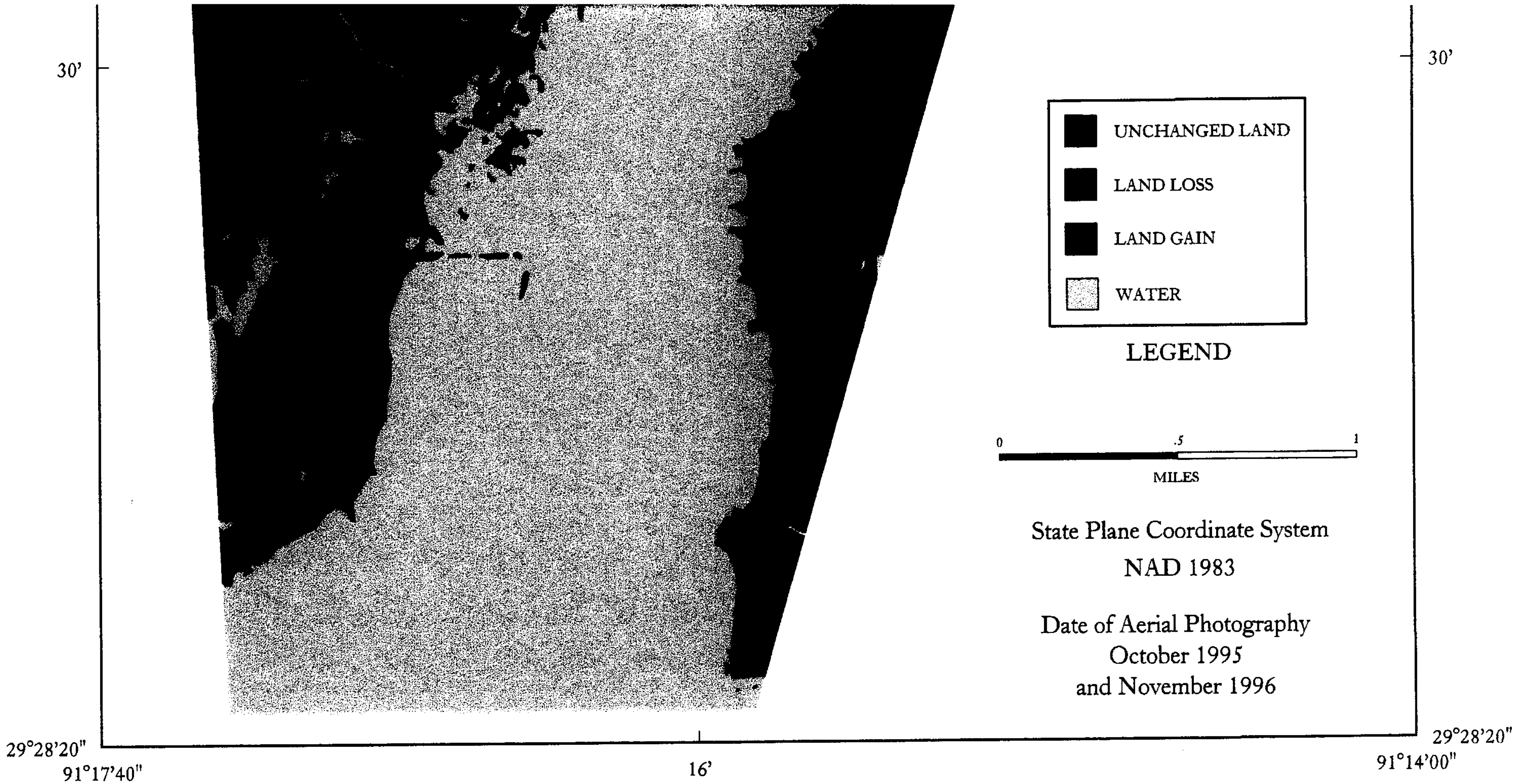


Figure 11. Shoreline changes of the Lower Atchafalaya River Horseshoe BUMP study area between October 1995 and November 1996.

Habitat Inventory

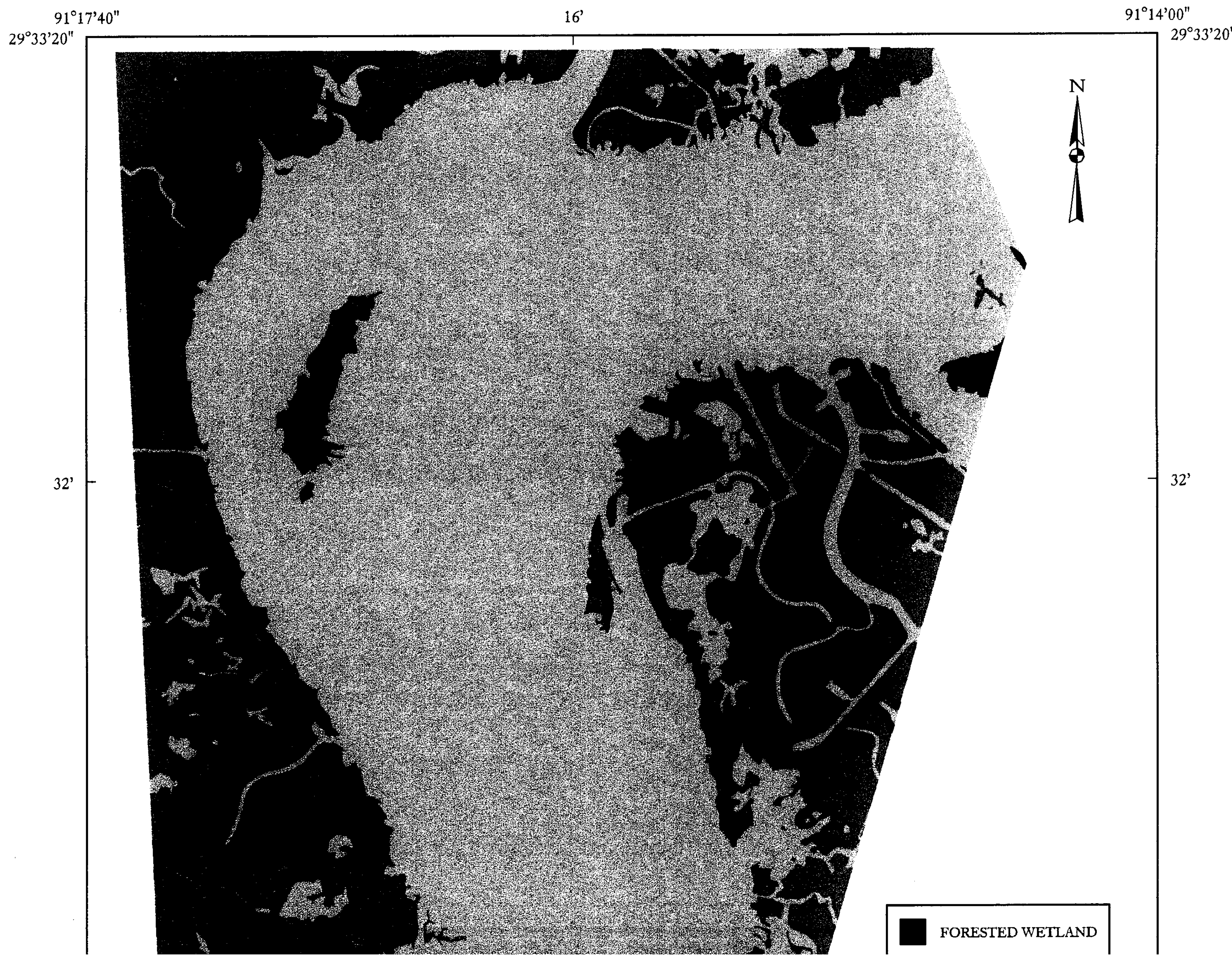
The aerial photographic interpretation combined with field surveys identified six major habitat types in the Lower Atchafalaya River Horseshoe BUMP study area. These habitats are further classified as natural, BUMP man-made, and other man-made. The natural class identifies habitats created by natural riverine and deltaic processes. The BUMP man-made (BUMP-made) class identifies the habitats created by the beneficial placement of dredged materials by the USACE-NOD. The non-BUMP man-made class (other-made) separates areas created that were not part of the BUMP effort, such as areas created in association with the oil industry access and pipeline canals. On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

Table 2 lists the areas of the three habitat types found in the Horseshoe study area in December 1985. The location and arrangement of these habitats are presented in figure 12. The total area of the study area was 3104.1 acres. Of this total, 2903.8 acres were natural and 200.3 acres were man-made or 93.5 percent were natural and 6.5 percent were man-made. There were no areas identified as BUMP in December 1985. In order of decreasing size and importance the largest habitat found was natural fresh marsh (2532.9 acres) followed by natural forested wetland (322.4 acres), other-made forested wetland (200.3 acres), and natural shrub/scrub (48.5 acres).

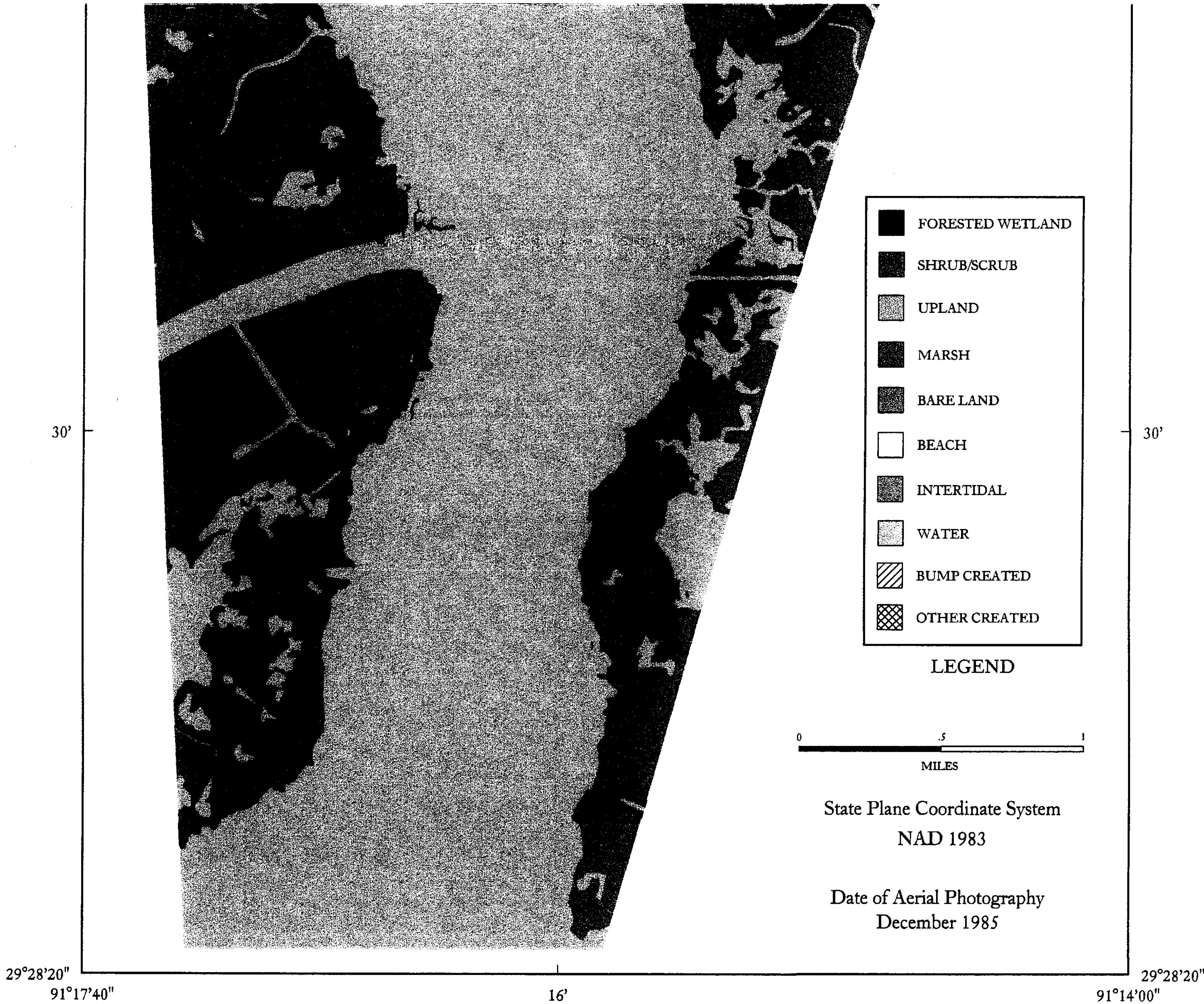
In terms of habitat totals, fresh marsh (2532.9 acres or 81.6%) dominated the Horseshoe study area landscape.

TABLE 2
December 1985 Habitat Inventory of the Lower Atchafalaya River Horseshoe

HABITAT	TOTAL	NATURAL	NON-BUMP MAN-MADE
Fresh Marsh	2532.9	2532.9	0
Shrub/Scrub	48.5	48.5	0
Forested Wetland	522.7	322.4	200.3
Habitat Total	3104.1	2903.8	200.3



91°17'40"
29°33'20"
16'
91°14'00"
29°33'20"
N
32'
32'
FORESTED WETLAND


FORESTED WETLAND
SHRUB/SCRUB
UPLAND
MARSH
BARE LAND
BEACH
INTERTIDAL
WATER
BUMP CREATED
OTHER CREATED
LEGEND
0
.5
1
MILES
State Plane Coordinate System
NAD 1983
Date of Aerial Photography
December 1985
30'
30'
29°28'20"
91°17'40"
16'
29°28'20"
91°14'00"

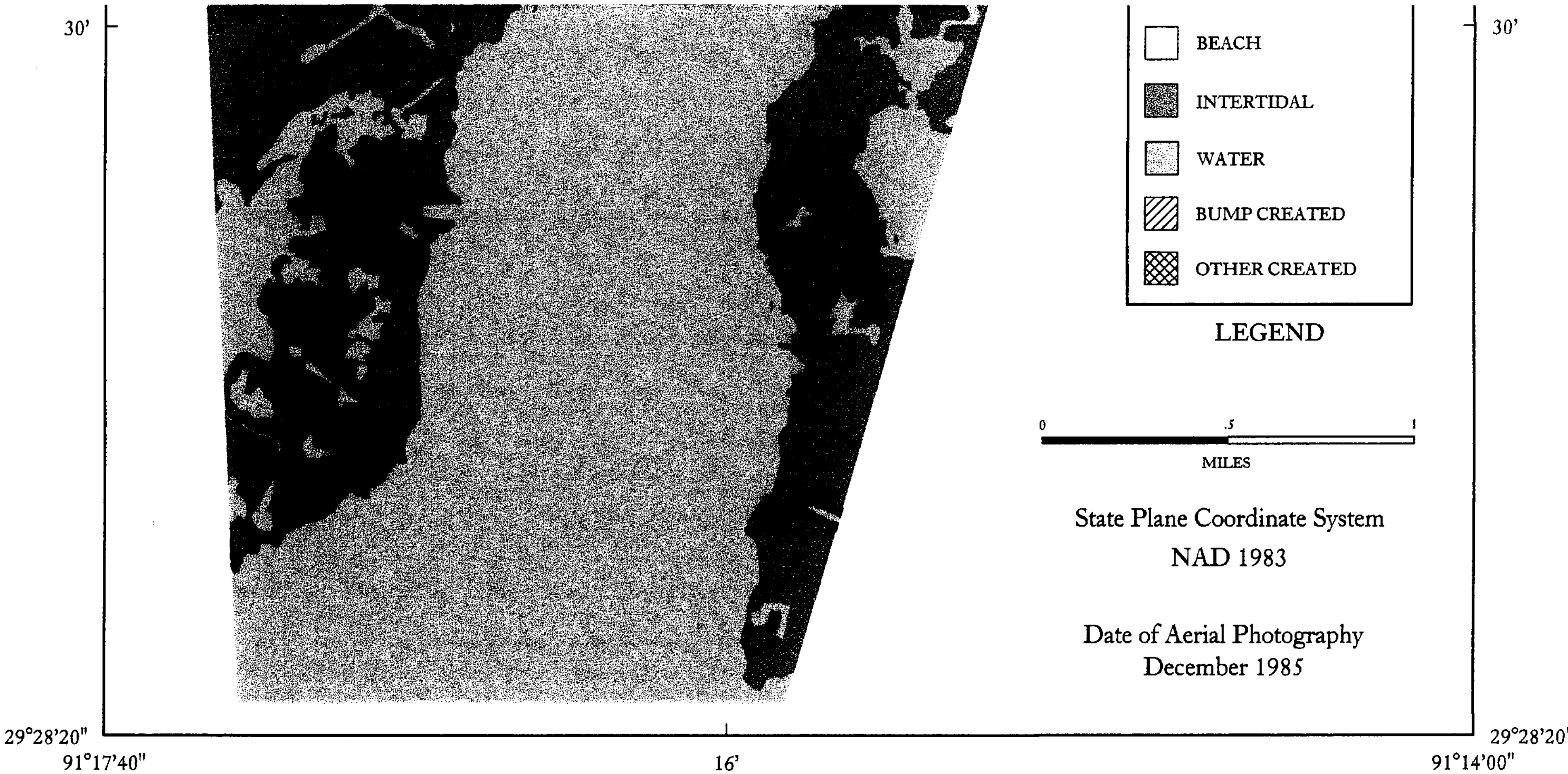


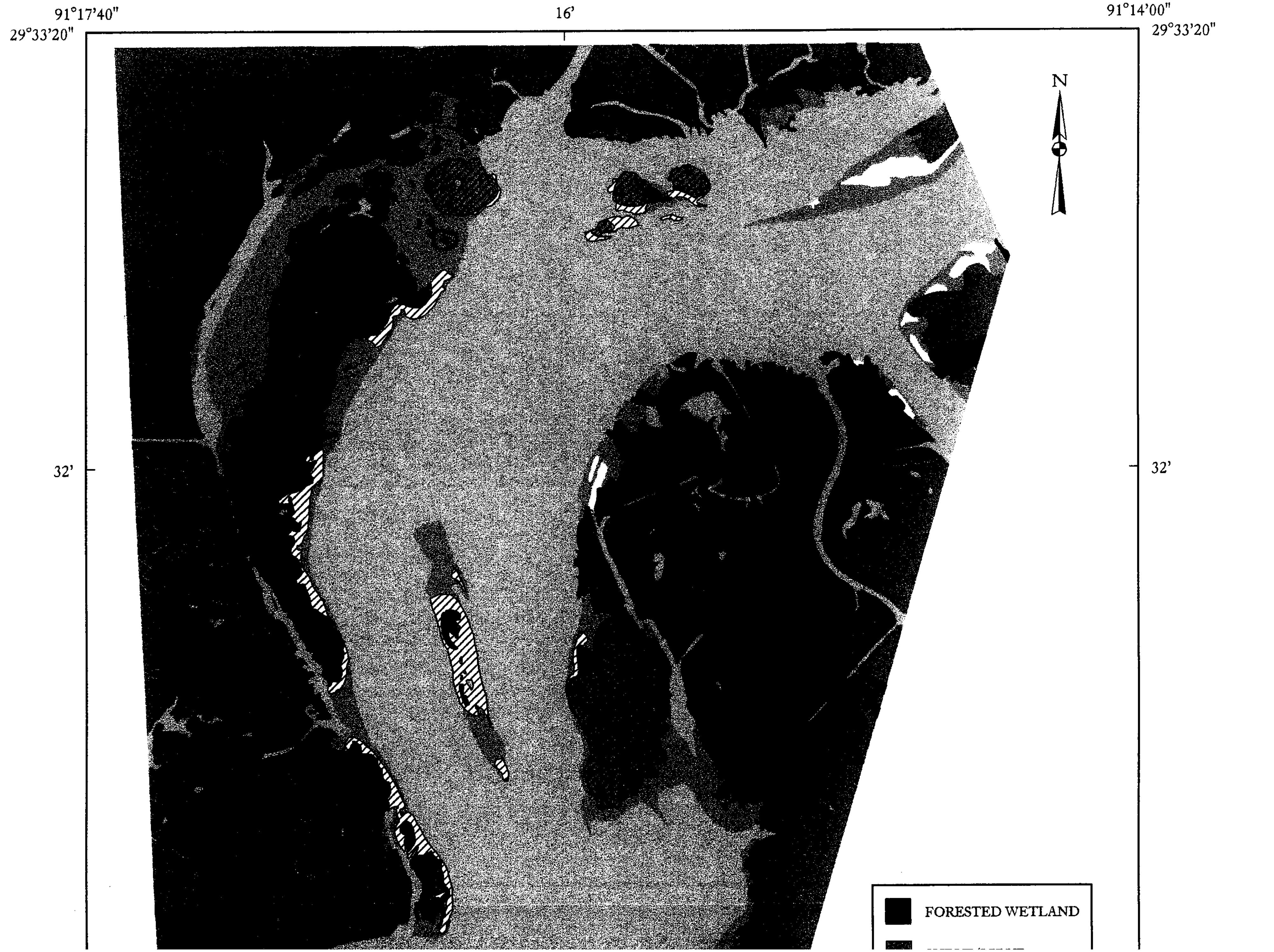
Figure 12. Habitat inventory map of the Lower Atchafalaya River Horseshoe BUMP study area in December 1985.

Table 3 lists the areas of the five habitats found in the Horseshoe study area in October 1995. The location and arrangement of these habitats is presented in figure 13. In 1995, the total area of the Horseshoe study area was calculated at 4196.1 acres. Of this total, 3444.3 acres were natural and 751.8 acres were man-made including 206.9 acres of other-made and 544.7 acres of BUMP-made, or 82.1 percent was natural, 5.0 percent was other-made, and 13.0 percent was BUMP-made. In order of decreasing size and importance, the largest habitat found was natural fresh marsh (2983.4 acres) followed by BUMP-made fresh marsh (290.3 acres), BUMP-made bare land (133.6 acres), natural shrub/scrub (116.1 acres), BUMP-made beach (85.5 acres), natural beach (28.9 acres), and BUMP-made shrub/scrub (7.5 acres).

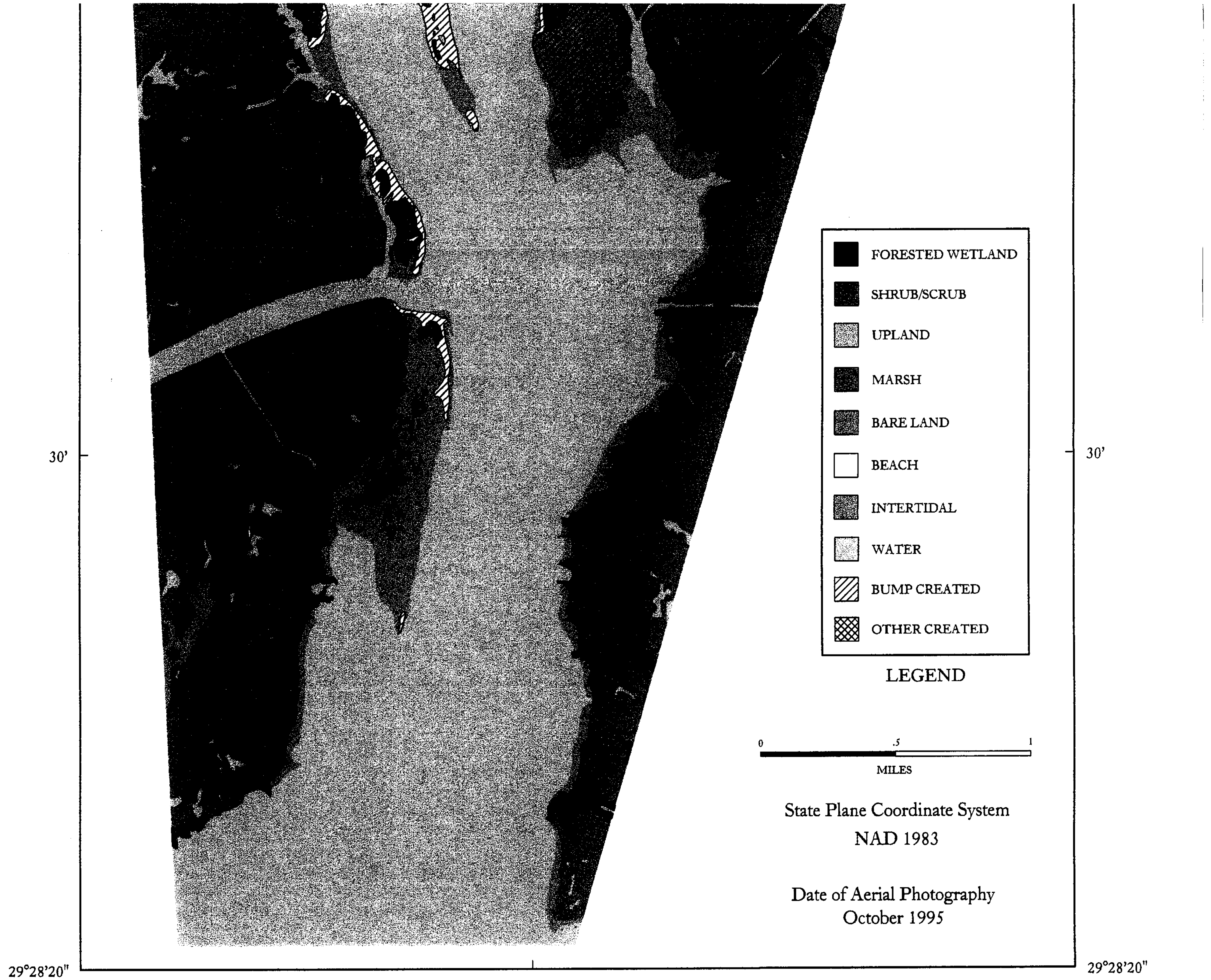
In terms of total area, fresh marsh (3275.8 acres or 78.1%) dominated the Horseshoe landscape.

TABLE 3
October 1995 Habitat Inventory of the Lower Atchafalaya River Horseshoe

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	3275.8	2983.4	2.1	290.3
Shrub/Scrub	123.6	116.1	0	7.5
Forested Wetland	548.7	315.9	204.8	28.0
Bare	133.6	0	0	133.6
Beach	114.4	28.9	0	85.5
Habitat Total	4196.1	3444.3	206.9	544.9



91°17'40"
29°33'20"
16'
91°14'00"
29°33'20"
32'
32'
N
FORESTED WETLAND



30'
30'
29°28'20"
29°28'20"
FORESTED WETLAND
SHRUB/SCRUB
UPLAND
MARSH
BARE LAND
BEACH
INTERTIDAL
WATER
BUMP CREATED
OTHER CREATED
LEGEND
0
.5
1
MILES
State Plane Coordinate System
NAD 1983
Date of Aerial Photography
October 1995

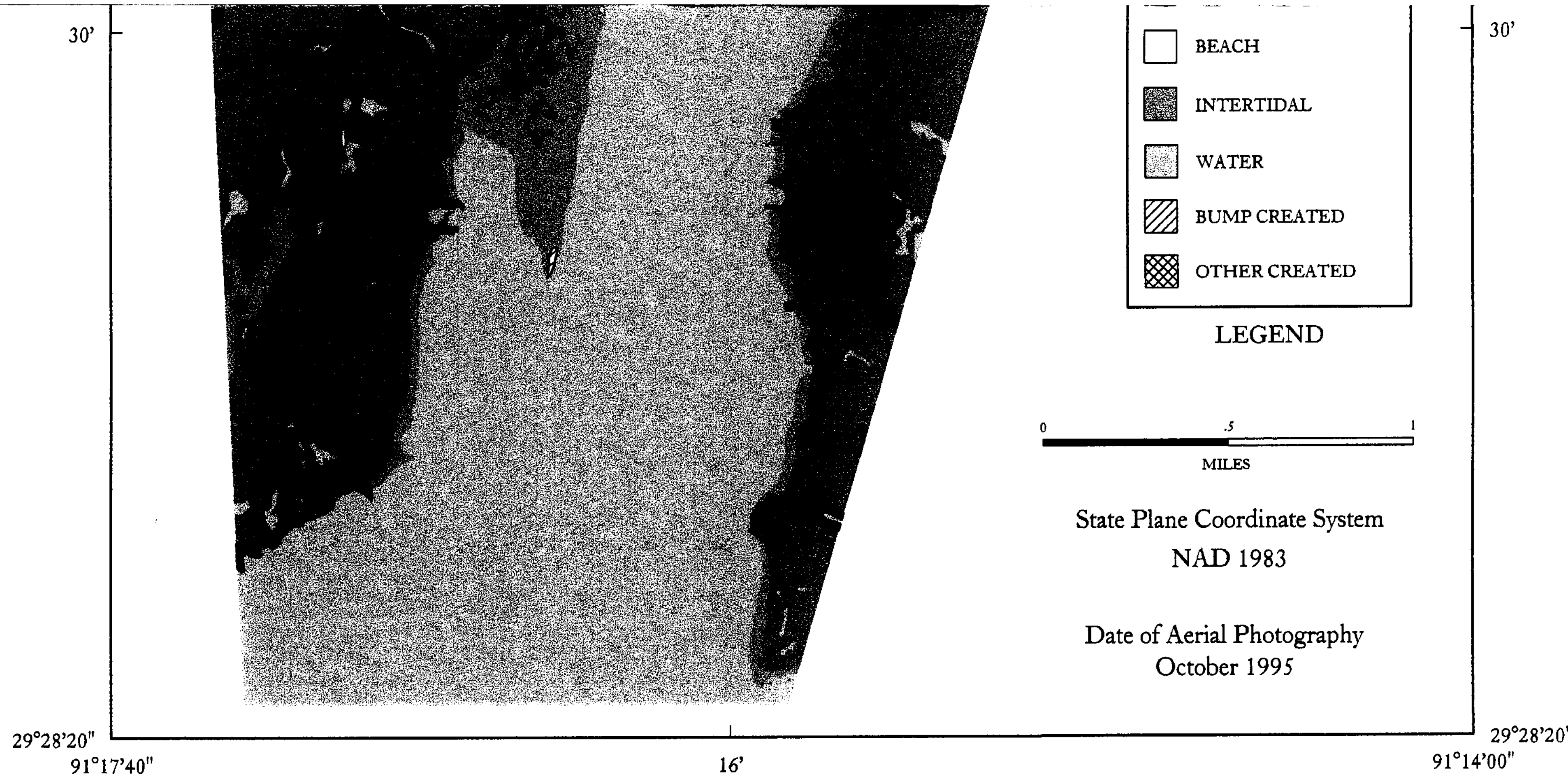


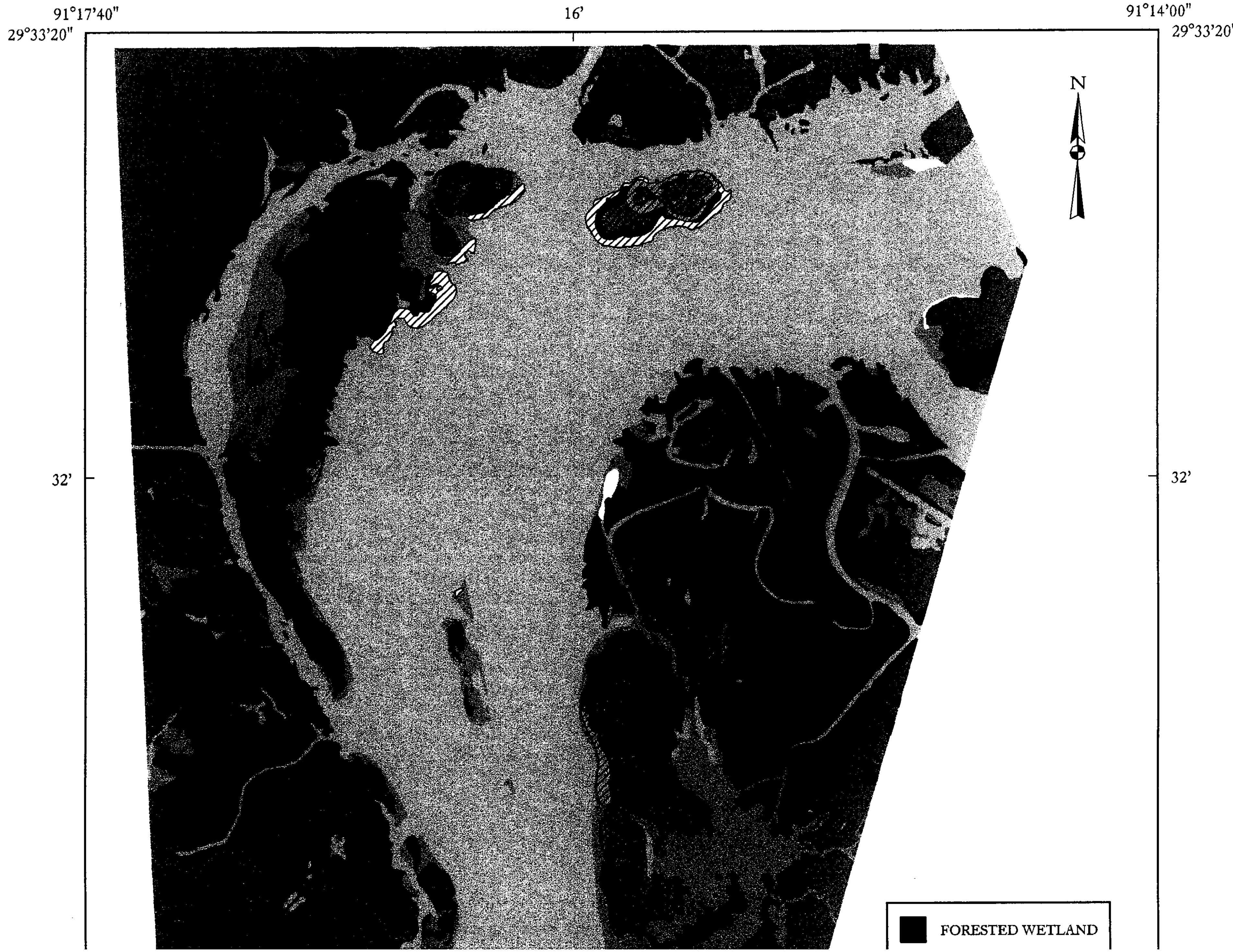
Figure 13. Habitat inventory map of the Lower Atchafalaya River Horseshoe BUMP study area in October 1995.

Table 4 lists the areas of the five habitats found in the Horseshoe study area in November 1996. The location and arrangement of these habitats is presented in figure 14. In 1996, the total area of the study area was calculated at 4034.1 acres. Of this total, 3223.4 acres were natural and 810.7 acres were man-made including 206.5 acres of other-made and 604.2 acres of BUMP-made, or 79.9 percent was natural, 5.1 percent was other-made, and 15.0 percent was BUMP-made. In order of decreasing size and importance, the largest habitat found was natural fresh marsh (2713.1 acres) followed by BUMP-made fresh marsh (351.6 acres), natural shrub/scrub (145.0 acres), BUMP-made bare land (126.4 acres), BUMP-made shrub/scrub (48.6 acres), natural bare land (45.2 acres), BUMP-made beach (31.0 acres), BUMP-made upland (19.3 acres), natural beach (7.5 acres), other-made marsh (1.1 acres), and other-made bare land (0.5 acres).

In terms of total area, fresh marsh (2713.1 acres or 67.3%) dominated the Horseshoe landscape.

TABLE 4
November 1996 Habitat Inventory of the Lower Atchafalaya River Horseshoe

HABITAT	TOTAL	NATURAL	OTHER MAN-MADE	BUMP MAN-MADE
Marsh	3065.8	2713.1	1.1	351.6
Upland	19.3	0	0	19.3
Shrub/Scrub	193.6	145.0	0	48.6
Forested Wetland	544.7	312.5	204.9	27.3
Bare	172.1	45.2	0.5	126.4
Beach	38.6	7.6	0	31.0
Habitat Total	4034.1	3223.4	206.5	604.2



91°17'40"
29°33'20"
16'
91°14'00"
29°33'20"
32'
32'
N
FORESTED WETLAND

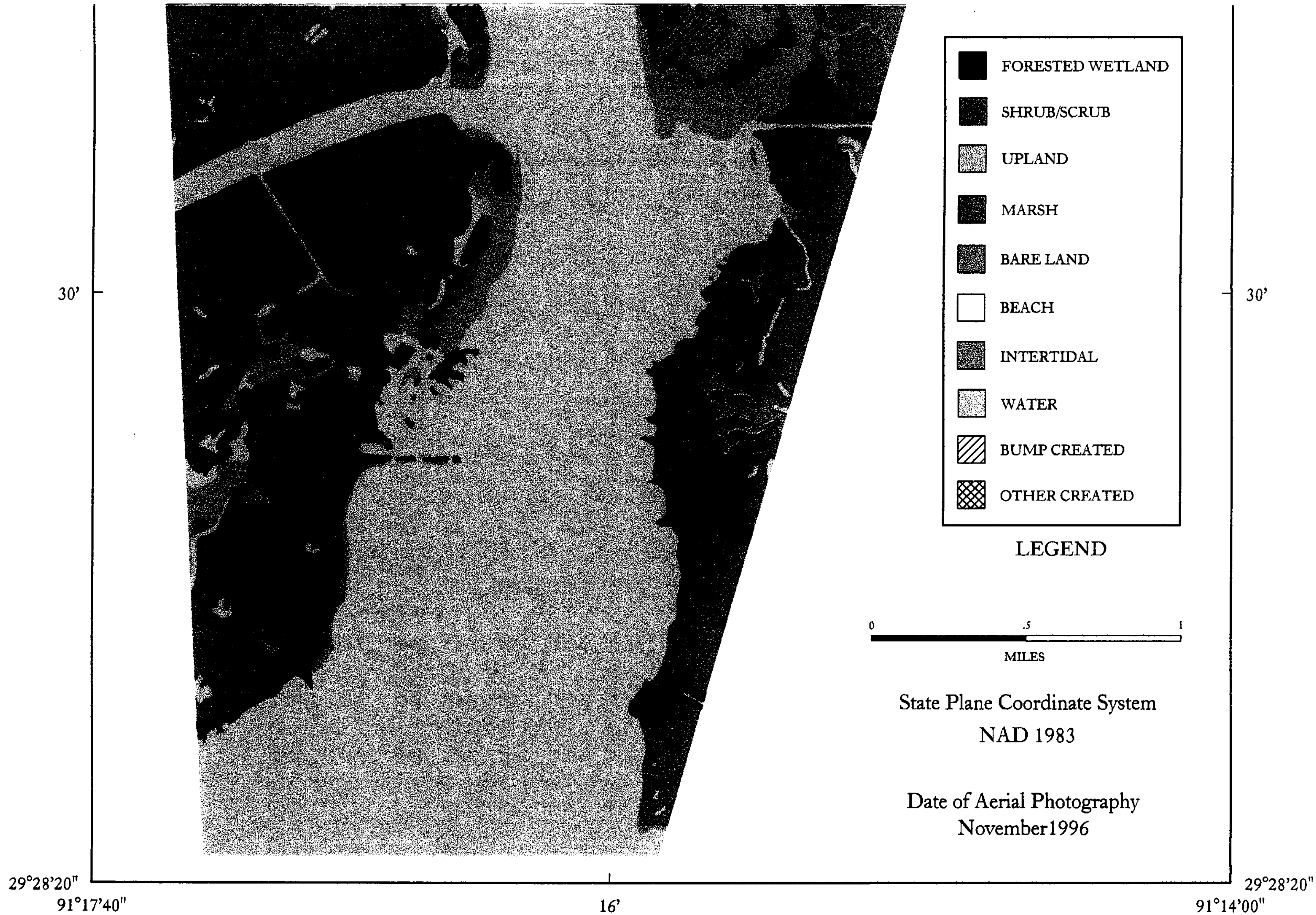


Figure 14. Habitat inventory map of the Lower Atchafalaya River Horseshoe BUMP study area in November 1996.

Habitat Change

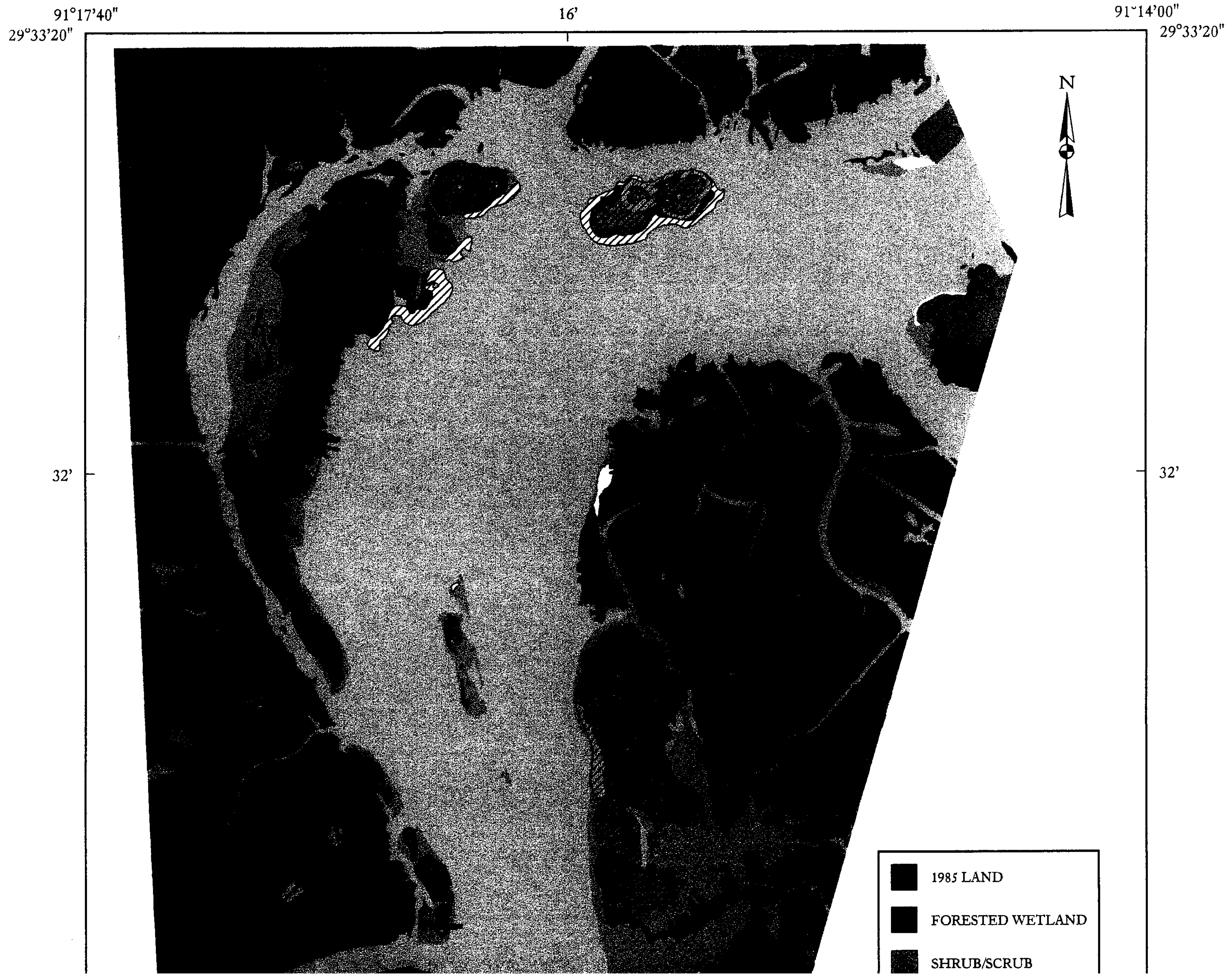
Figure 15 shows the cumulative creation of new habitat, including natural, other man-made and BUMP man-made, in the Lower Atchafalaya River Horseshoe study area between December 1985 and November 1996. The total area increased by +930.0 acres which represents a 30 percent increase in area between 1985 and 1996. Of this increase in area, 319.6 acres were natural, 6.2 acres were other-made, and 604.2 acres were BUMP-made by the placement of dredged material. Table 5 lists the major habitat changes during the period between December 1985 and November 1996.

The major habitat-increase by natural processes was the cumulative increase in natural fresh marsh (+180.2 acres) over this 10.9-year period. There was an over-all increase of +450.5 acres between 1985 and 1995 which was reduced by -270.3 acres in the one year period between 1995 and 1996. Natural shrub/scrub also had an cumulative increase between 1985 and 1996 of +96.5 acres. The major habitat-increase by man-made processes occurred in the BUMP-made habitats, including fresh marsh (+351.6 acres) and bare land (+126.4 acres).

Figure 16 shows a time series of habitat changes in the Lower Atchafalaya River Horseshoe study area. Figure 16A graphs the natural habitat changes over time. Natural marsh development dominates the natural habitat class. Figure 16B graphs the man-made habitat changes. Forested wetland, fresh marsh, shrub/scrub and bare land dominate the man-made class.

Figure 17 documents the creation of habitats at the Lower Atchafalaya River Horseshoe study area between December 1985 and October 1995.

Figure 18 documents the creation of habitats at the Horseshoe between October 1985 and November 1996.


91°17'40"
29°33'20"
16'
91°14'00"
29°33'20"
32'
32'
N
1985 LAND
FORESTED WETLAND
SHRUB/SCRUB

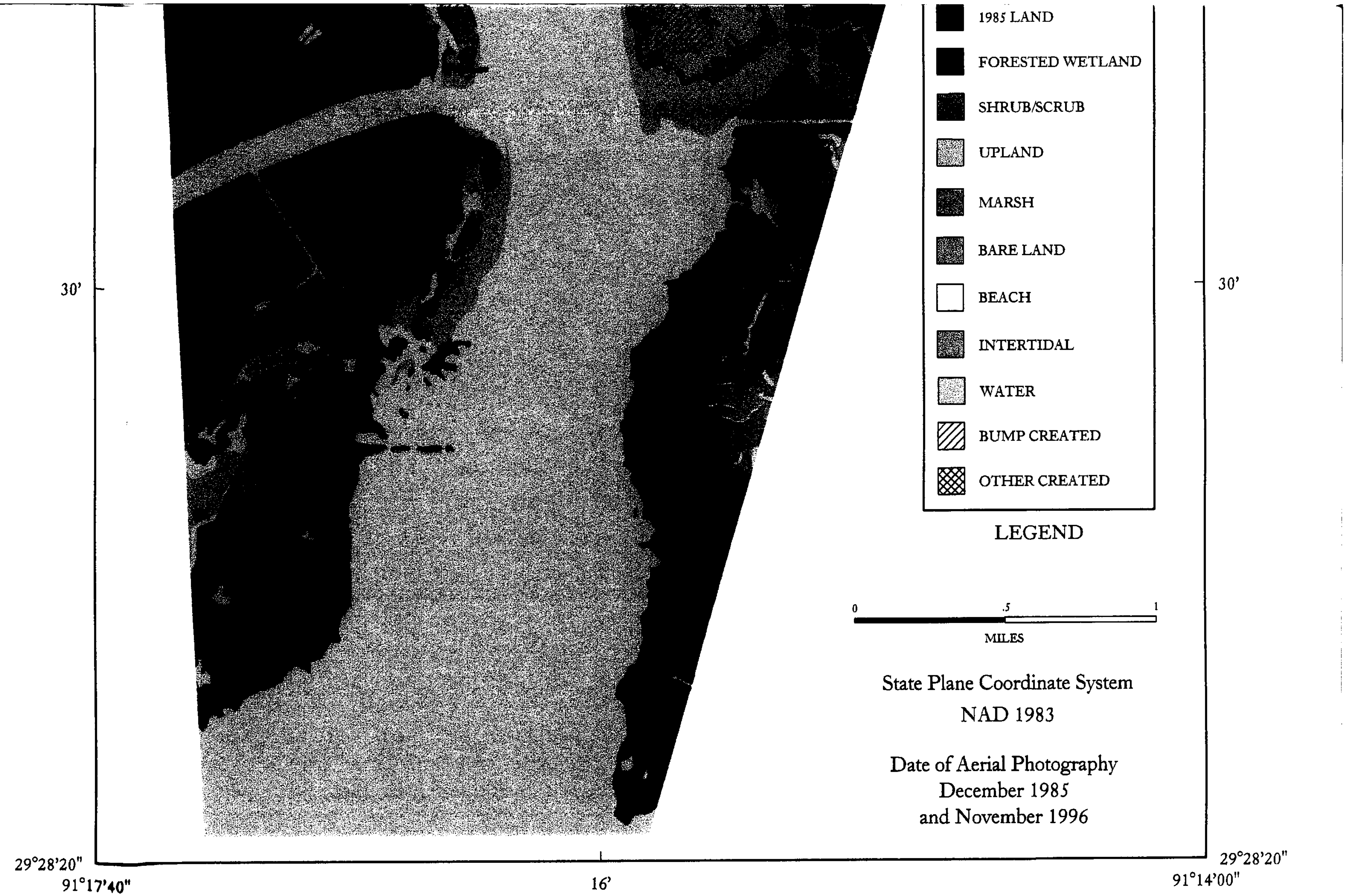
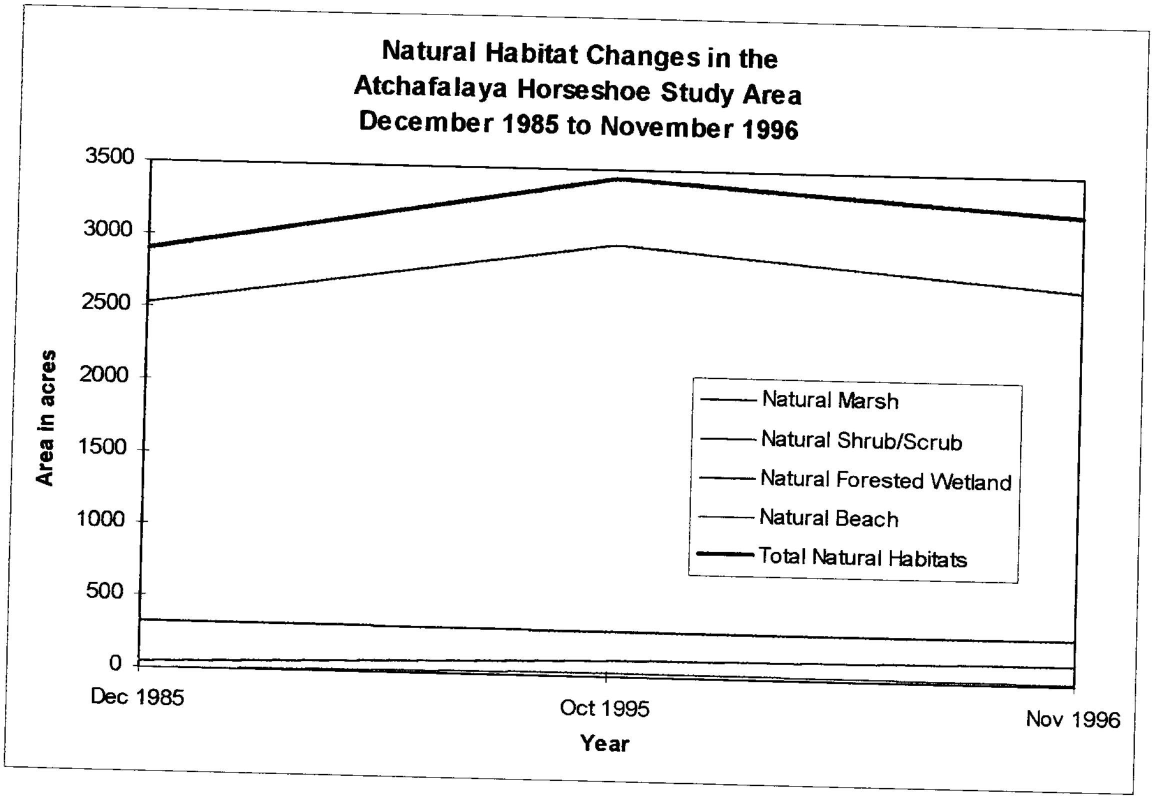


Figure 15 Map of the Lower Atchafalaya River Horseshoe BUMP study area showing the new habitats that developed between December 1985 and November 1996.

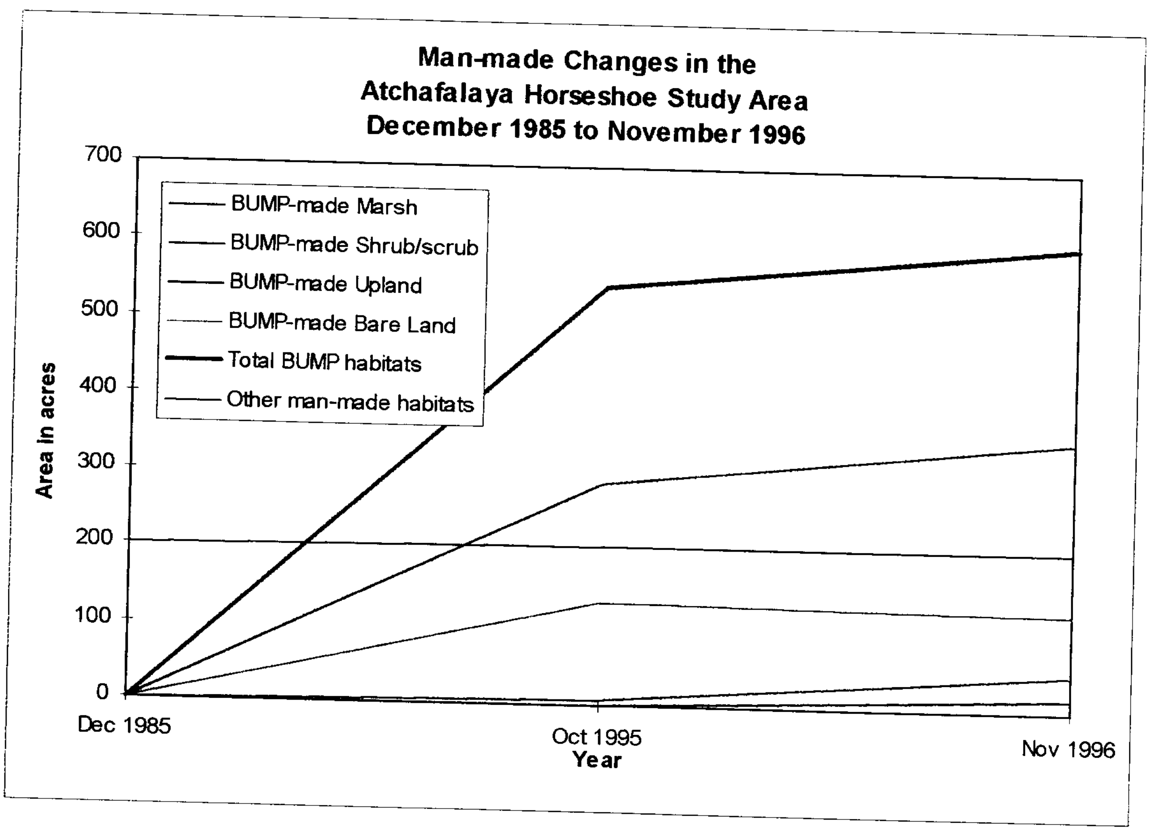
TABLE 5
Changes in Total Acres of Each Habitat in the Lower Atchafalaya River Horseshoe between December 1985 and November 1996

HABITAT	1985-1995[1]	1995-1996[1]	1985-1996[1]
Natural Fresh Marsh	+450.5	-270.3	+180.2
Natural Shrub/Scrub	+67.6	+28.9	+96.5
Natural Forested Wetland	-6.5	-3.4	-9.9
Natural Bare Land	--	+45.2	+45.2
Natural Beach	+28.9	-21.3	+7.6
Total Natural Habitats	+540.5	-220.9	+319.6
Other Man-made Fresh Marsh	+2.1	-1.0	+1.1
Other Man-made Shrub/Scrub	--	--	--
Other Man-made Forested Wetland	+4.5	-0.1	+4.6
Other Man-made Bare Land	--	+0.5	+0.5
Other Man-made Beach	--	--	--
Total Other Man-made Habitats	+6.6	-0.4	+6.2
BUMP-made Marsh	+290.3	+61.3	+351.6
BUMP-made Upland	--	+19.3	+19.3
BUMP-made Shrub/scrub	+7.5	+41.1	-48.6
BUMP-made Forested Wetland	+28.0	-0.7	+27.3
BUMP-made Bare Land	+133.6	-7.2	+126.4
BUMP-made Beach	+85.5	-54.5	+31.0
Total BUMP-made Habitats	+544.9	+59.3	+604.2
HABITAT TOTAL	+1092.0	-162	+930.0

[1] in acres

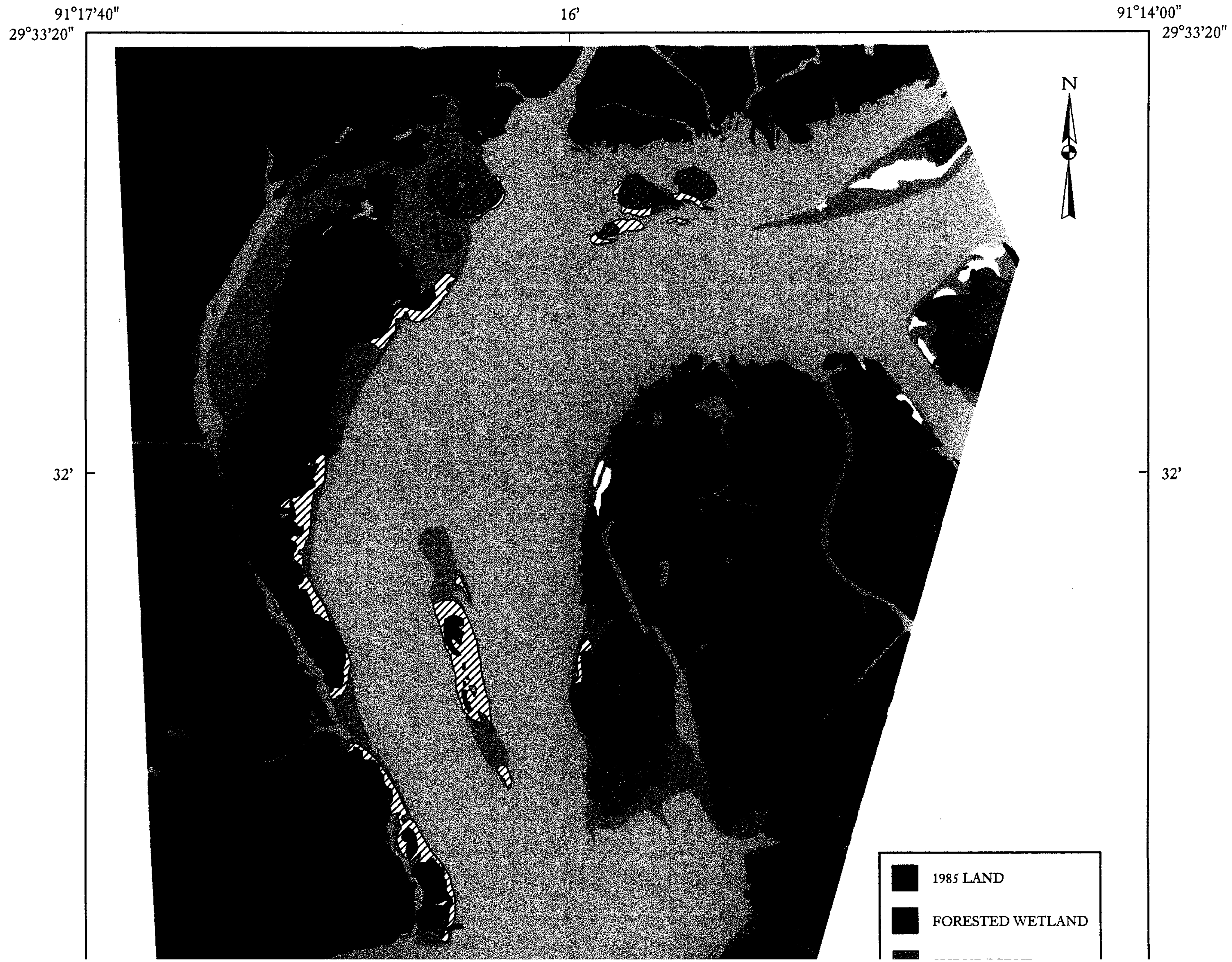


A



B

Figure 16. Time series showing the changes in total area of each habitat in the Lower Atchafalaya River Horseshoe BUMP study area between 1985, 1995 and 1996. A) natural habitat changes. B) man-made habitat changes.



91°17'40"
29°33'20"
16'
91°14'00"
29°33'20"
N
32'
32'
1985 LAND
FORESTED WETLAND

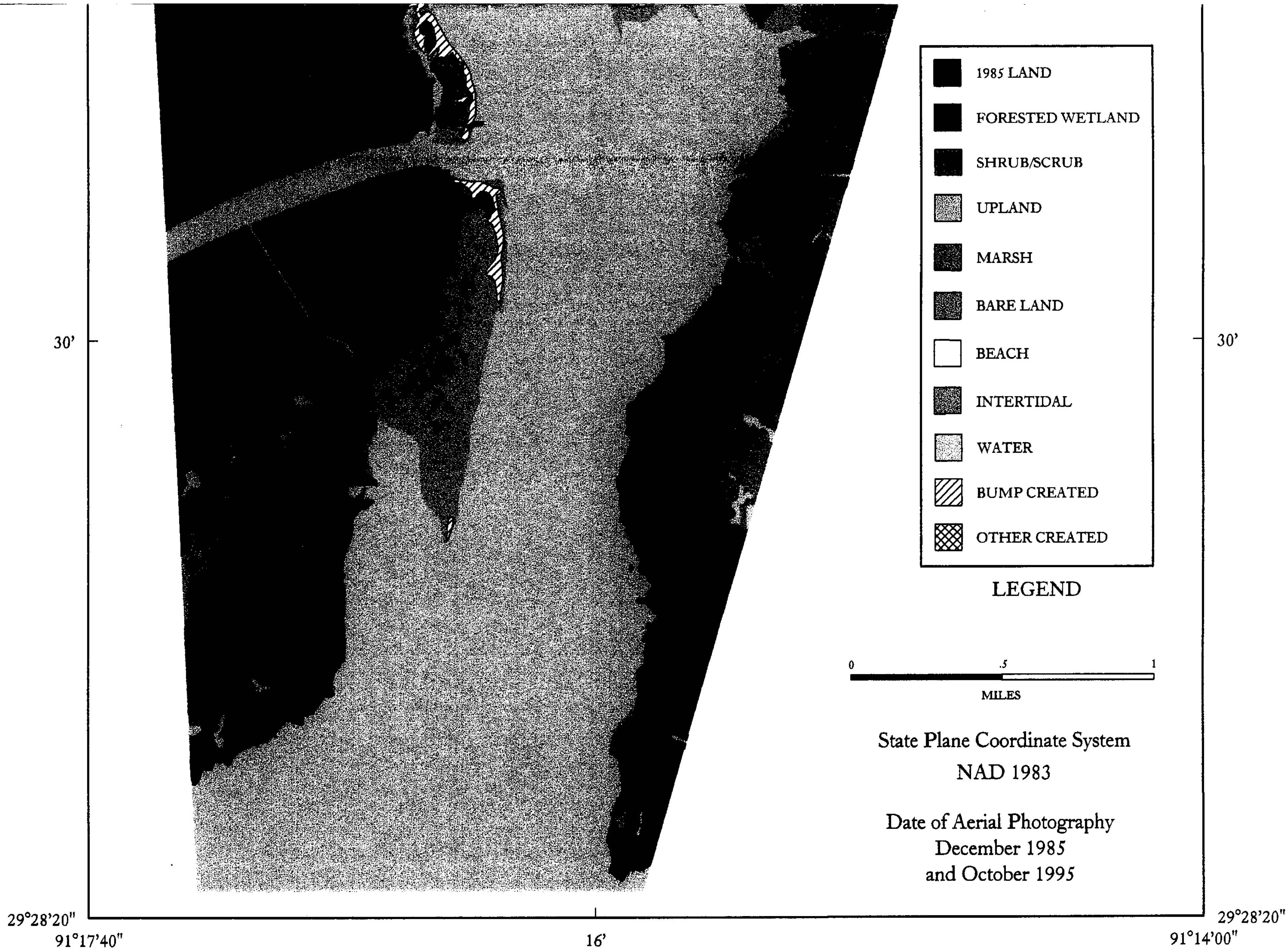
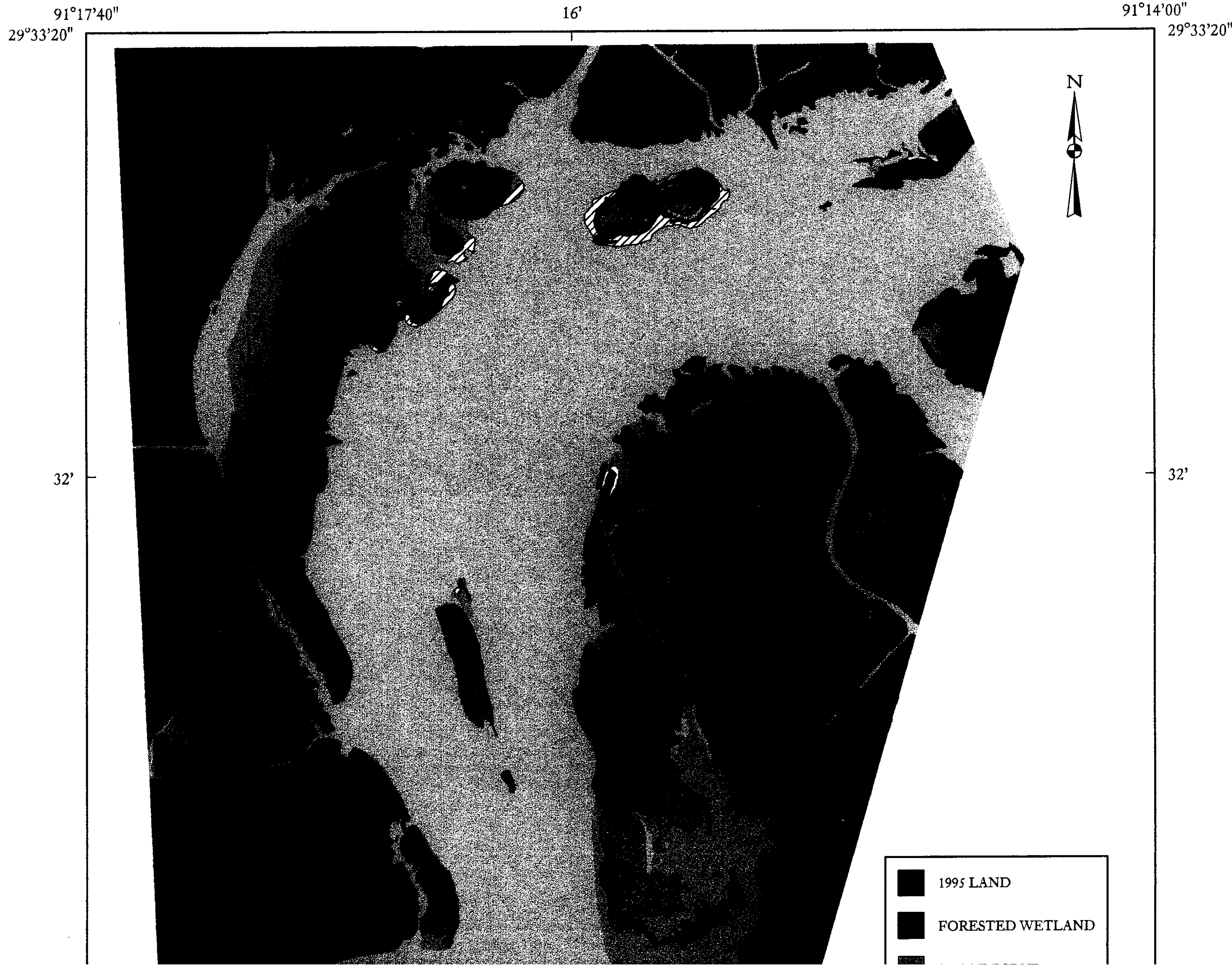


Figure 17. Map of the Lower Atchafalaya River Horseshoe BUMP study area showing the new habitats that developed between December 1985 and October 1995.



91°17'40"
29°33'20"
16'
91°14'00"
29°33'20"
32'
32'
N
1995 LAND
FORESTED WETLAND

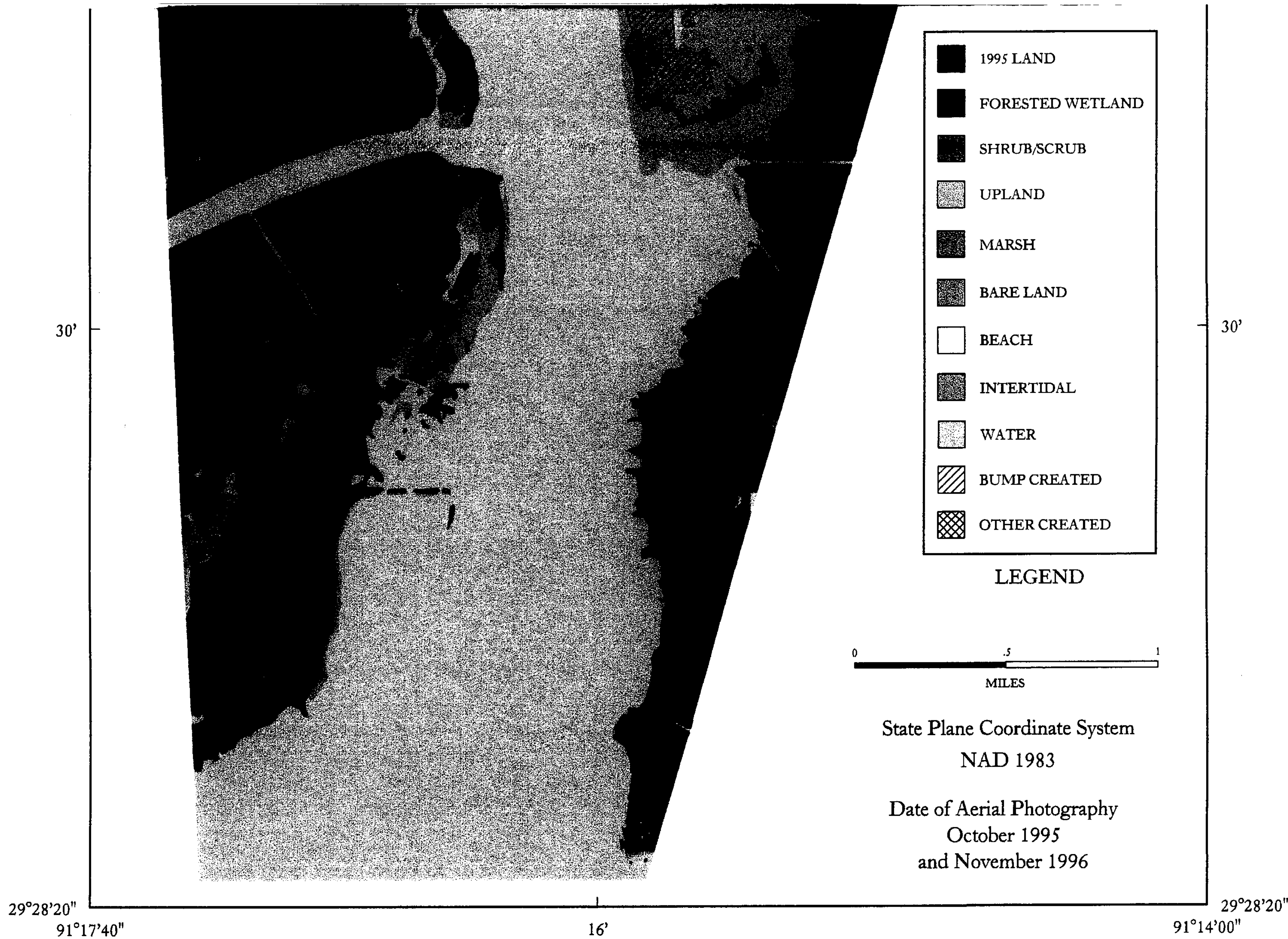


Figure 18. Map of the Lower Atchafalaya River Horseshoe BUMP study area showing the new habitats that developed between October 1995 and November 1996.

CONCLUSIONS

1. The Lower Atchafalaya River Horseshoe BUMP study area beneficial use is dominated by freshwater marshes, forested wetlands, shrub/scrub, and upland vegetation. Field surveys indicate the elevation most conducive to freshwater marsh development varies due to seasonal river stages but is generally below +2 feet MLG.

2. The Horseshoe study area increased in area by +930 acres between 1985 and 1996 at a rate of +85.3 acres per year. Between 1985 and 1995, the area of the Horseshoe increased by +1092.0 acres followed by a decrease between 1995 and 1996 of -162 acres. The area decrease is related to channel margin and interior pond changes.

3. Natural processes accounted for 34 percent of the cumulative increase, beneficial use of dredged material processes accounted for 65 percent of the increase, and other human processes accounted for 1 percent of the increase.

4. For natural areas, the greatest contributions to area increases were from fresh marsh (+180.2 acres) followed by shrub/scrub (+96.5 acres), and bare land (+45.2 acres).

5. For the beneficial use areas, the greatest contributions to area increase were from fresh marsh (+351.6 acres), followed by bare land (+126.4 acres), beach (+31.0 acres), forested wetland (+27.3 acres), and upland (+19.3 acres).

6. More than 58 percent of the area created by beneficial use of dredged material in the Horseshoe study area was fresh marsh .

REFERENCES

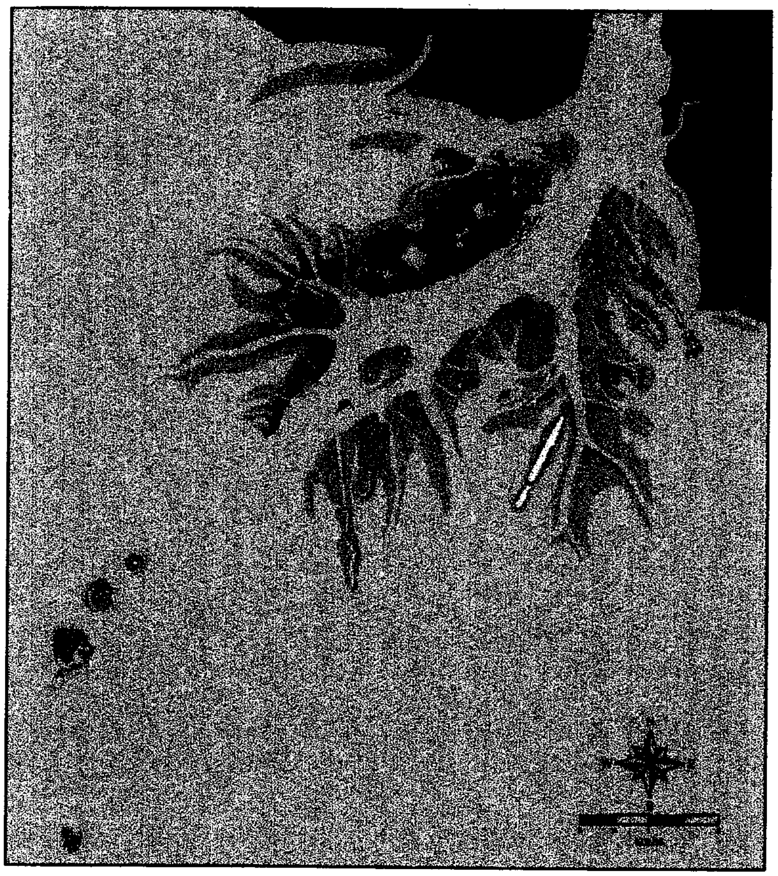
Penland, S. and Westphal, K.A., 1996. 1996 beneficial use monitoring program annual report; Part 1: Methodology. Report to the US Army Corps of Engineers - NOD. 16 pp.

U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Base Year 1985 through Fiscal Year 1996



Shea Penland, Karen A. Westphal, Qiang Tao, Chris Zganjar, Paul Connor, and Jamie Phillippe
Louisiana State University - Coastal Studies Institute
Baton Rouge, LA 70803

and

Linda Mathies, Beth Nord, and John Flanagan
Operations Division - Technical Support Branch (CELMN-OD-T)
U.S. Army Corps of Engineers - New Orleans District
New Orleans, LA 70160-0267

Baton Rouge, Louisiana
1997

TABLE OF CONTENTS

INTRODUCTION 9-1

DREDGED MATERIAL DISPOSAL HISTORY 9-4

FIELD SURVEY RESULTS 9-7
- Methodology 9-7
  - Elevation Profile Surveys 9-7
  - Vegetation Surveys 9-9
- Profiles 9-9
  - Andrew Island 9-10
  - Horseshoe Island 9-14
  - Ibis Island 9-18
- Vegetative Character 9-23
  - General Description 9-23
  - Vegetative Community Types in the Atchafalaya Delta 9-23

GIS ANALYSIS RESULTS 9-25
- Shoreline Changes: 1985-1996 9-25
- Habitat Inventory 9-27
- Habitat Change 9-35

CONCLUSIONS 9-40

REFERENCES 9-40

APPENDIX 9A 9A-1

LIST OF FIGURES

Figure 1. The location of the Atchafalaya Bay and Bar navigation channel in Louisiana. . . . 9-1

Figure 2. The Lower Atchafalaya River Bay and Bar BUMP study area showing the minimum coverage of the aerial photo-mosaic and limits of the area digitized. 9-3

Figure 3. Dredged material disposal history for the Lower Atchafalaya River Bay and Bar navigation channel through 1996. 9-5

Figure 4. Location of Andrew Island, Horseshoe Island, and Ibis Island BUMP study sites, and the benchmarks available to reference the elevation data at the Atchafalaya River Bay and Bar delta. 9-8

Figure 5. A schematic diagram of the BUMP profile locations and configurations for Andrew Island in the Atchafalaya River delta. 9-10

Figure 6. A comparison of 1995 and 1996 elevation data at Andrew Island in the Atchafalaya River delta. A) Profile E-E' at stake 2-0. B) Profile H-H' at stake 2-3. C) Profile I-I' at stake 1-0. 9-11

Figure 7. Elevation profile ANI 2-0 from Andrew Island in the Atchafalaya River delta showing habitat distribution change. A) 1995 data. B) 1996 data. 9-12

Figure 8. Profile ANI 1-0 from Andrew Island in the Atchafalaya River delta showing habitat distribution changes. A) 1995 data. B)1996 data. 9-13

Figure 9. Schematic diagram of the BUMP profile locations and configurations for the eastern lobe of Horseshoe Island in the Atchafalaya River delta. 9-14

Figure 10. A comparison of 1995 and 1996 elevation data at Horseshoe Island in the Atchafalaya River delta. A) Profile A-A' at stake 3-0. B) Profile E-E' at stake 2-0. C) Profile I-I' at stake 1-0. 9-15

Figure 11. Elevation profile EHI 3-0 from Horseshoe Island in the Atchafalaya River delta showing habitat distribution changes. A) 1995 data. B) 1996 data. 9-16

Figure 12. Elevation profile EHI 2-0 from Horseshoe Island in the Atchafalaya River delta showing habitat distribution changes. A) 1995 data. B) 1996 data. 9-17

Figure 13. Schematic diagram of the BUMP profile locations and configurations for Ibis Island in the Atchafalaya River Bay and Bar delta. 9-19

Figure 14. Profile IBS 1-1 from Ibis Island in the Atchafalaya River delta 9-20

Figure 15. Profile IBS 2-1from Ibis Island in the Atchafalaya River delta. 9-21

Figure 16. Profile IBS 3-1 from Ibis Island in the Atchafalaya River delta. 9-22

Figure 17. Graph of the area of the Atchafalaya delta over time. 9-25

Figure 18. Land loss/gain map of the Atchafalaya River delta between December 1985 and November 1996. 9-26

Figure 19. Habitat inventory map of the Atchafalaya delta in December 1985. 9-28

Figure 20. Habitat inventory map of the Atchafalaya delta in November 1994. 9-30

Figure 21. Habitat inventory map of the Atchafalaya delta in November 1995. 9-32

Figure 22. Habitat inventory map of the Atchafalaya delta in November 1996. 9-34

Figure 23. Map of the Atchafalaya delta showing the new habitats that developed between December 1985 and November 1996. 9-36

Figure 24. Time series showing the changes in total area of each habitat in the Atchafalaya River delta between 1972 and 1996. A) natural habitat changes. B) man-made habitat changes. 9-39

LIST OF TABLES

TABLE 1
December 1985 Habitat Inventory of the Atchafalaya Delta 9-27

TABLE 2
November 1994 Habitat Inventory of the Atchafalaya Delta 9-29

TABLE 34
November 1995 Habitat Inventory of the Atchafalaya Delta 9-31

TABLE 4
November 1996 Habitat Inventory of the Atchafalaya Delta 9-33

TABLE 5
Changes in Total Acres of Each Habitat in the Atchafalaya Delta
between December 1985 and November 1996 9-37

INTRODUCTION

The Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel (Atchafalaya Bay and Bar) is located 20 miles south of Morgan City, Louisiana. This area is dominated by the growth of the Atchafalaya River delta over the last 50 years. The U.S. Army Corps of Engineers - New Orleans District (USACE-NOD) maintains this navigation channel through the prograding Atchafalaya delta complex (Figure 1).

The Beneficial Use of dredged material Monitoring Program (BUMP) at Louisiana State University - Coastal Studies Institute (LSU-CSI) is documenting the disposal and beneficial use of dredged material using aerial photography, geographical information system (GIS) analysis, and field surveys through the sponsorship of the USACE-NOD. BUMP results are provided in map series, annual reports, and scientific literature.

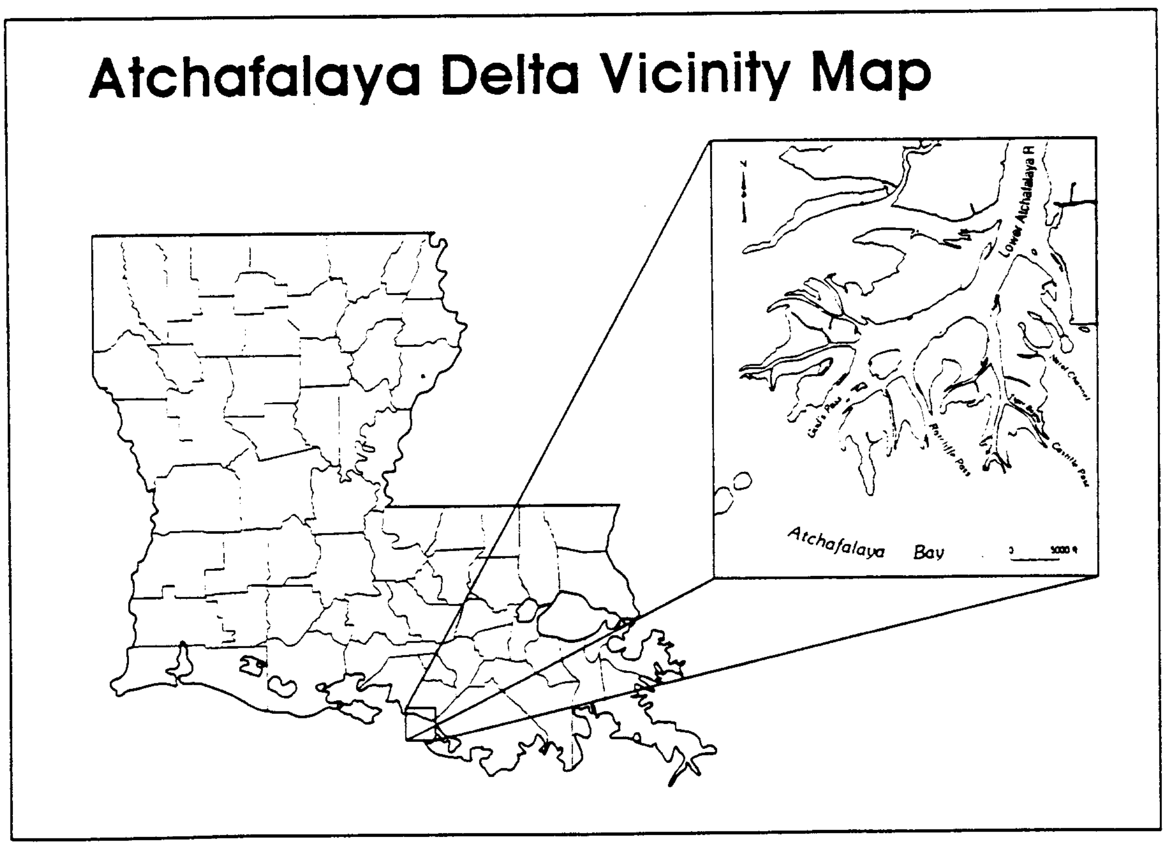


Figure 1. The location of the Atchafalaya Bay and Bar navigation channel in Louisiana.

In this report, LSU presents the new results of the BUMP analysis at the Lower Atchafalaya River Bay and Bar navigation channel. This is the ninth part of the nine part Beneficial Use of dredged material Monitoring Program (BUMP), 1996 Final Report, representing monitoring results through the USACE-NOD Fiscal Year 1996. The nine parts are:

- Part 1: Introduction and Methodology
- Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
- Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
- Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
- Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
- Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass
- Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Channel, Louisiana - Bay Chaland
- Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe
- Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Using aerial photography, LSU classified the natural and man-made habitats in the study area for December 1985, November 1994, October 1995, and November 1996 including the Fiscal Year 1994, 1995, and 1996 maintenance events. Through the GIS analysis, these areas were calculated and changes documented for 1985, and 1996. Field surveys were conducted in April 1995 on artificial delta lobes named Andrew Island and Horseshoe Island created/constructed through the beneficial use of the dredged material during routine maintenance operations in 1994. In October 1996, transects were revisited at Andrew Island and Horseshoe Island. In addition, in October 1996 new transects were established on Ibis Island which was created during routine maintenance dredging operations in 1995. Habitats were ground truthed and survey transects were established to document vegetation species, stacking elevations, and compaction/subsidence. Figure 2 shows the area of minimum aerial photo-mosaic coverage and the limit of the digitized area.

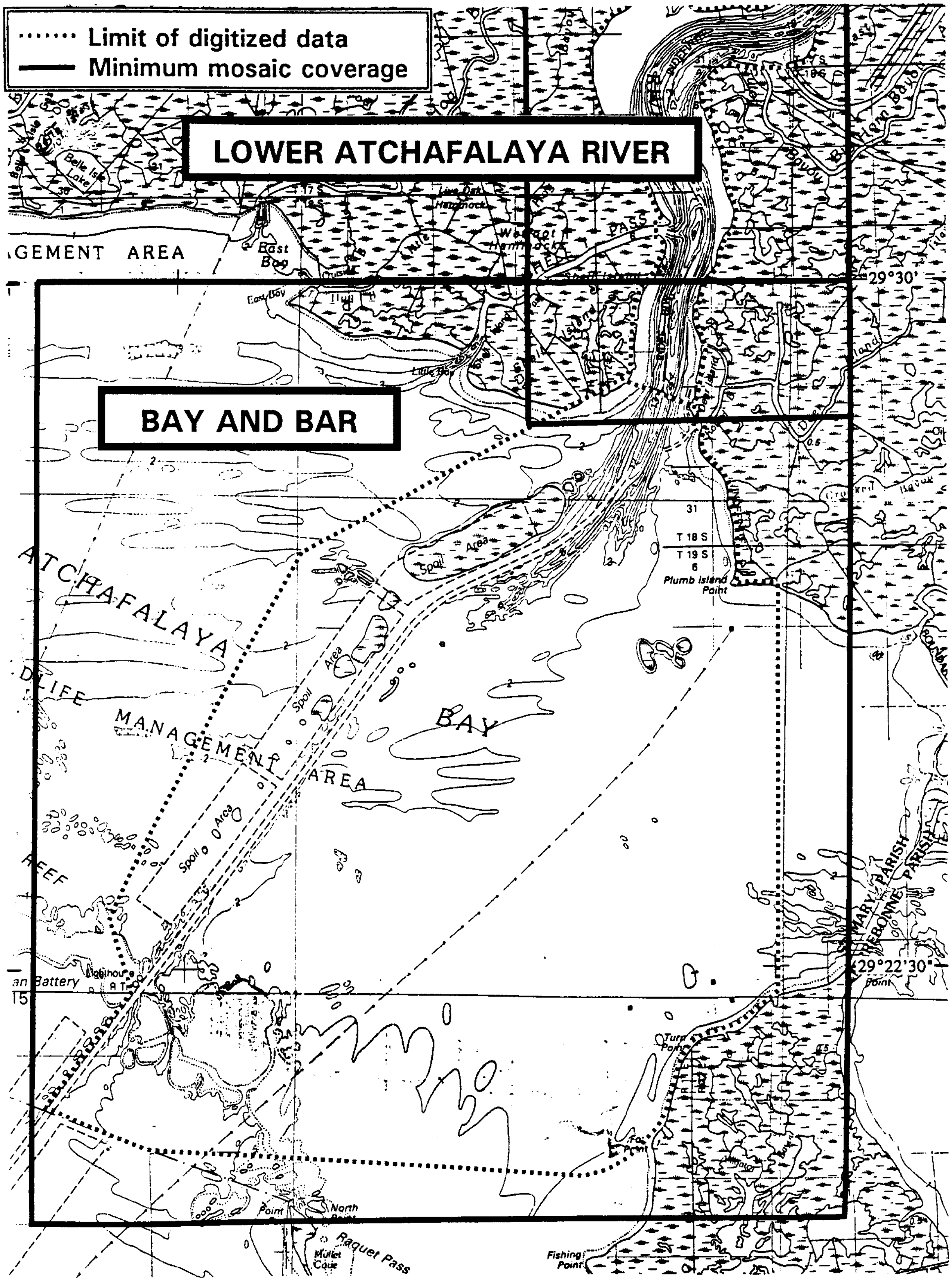


Figure 2. The Lower Atchafalaya River Bay and Bar BUMP study area showing the minimum coverage of the aerial photo-mosaic and limits of the area digitized.

DREDGED MATERIAL DISPOSAL HISTORY

The Rivers and Harbors Act of 25 June 1910 authorized the USACE-NOD to construct and maintain the Atchafalaya River, Morgan City to the Gulf of Mexico, Louisiana, project which provided a navigation channel 20 feet deep, 200 feet wide and 15.75 miles long from the 20 foot contour in the Atchafalaya Bay, approximately 4 miles beyond the mouth of the Atchafalaya River, to the 20 foot contour in the Gulf of Mexico. Traffic sufficient to warrant maintenance of the authorized navigation channel to full project dimensions did not immediately develop. The channel was progressively enlarged during maintenance events from 10 by 100-feet in 1939 to 20 by 200-feet in 1974.

The Rivers and Harbors Act of 1968 authorized construction and maintenance of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana, project which incorporated the existing project and provided an increase in channel width of the navigation channel in Atchafalaya Bay and Bar to 400 feet. Construction of the channel in the bay and Gulf was initiated in April, 1974 and was complete in December of the same year.

Dredged material disposal history prior to construction of the enlarged channel in 1974 is sketchy. Dredging records dating back to 1957 indicate that maintenance of *discontinuous* reaches of the bay and/or bar channels occurred on an annual basis from 1957 until 1974 except for 1958. It is likely that dredged material was placed unconfined in open water on either side of the navigation channel.

Dredged material removed during new work dredging associated with construction of the 400 foot navigation channel in 1974 was placed in open water and on subaerial levees of existing delta lobes on the west side of the navigation channel. During maintenance events beginning in 1979 and continuing on an annual basis through 1985, this practice continued. During this period, Big Island was created; dredged material was used to construct a campground at the Louisiana Department of Wildlife and Fisheries Camp; dredged material was used to construct islands for colonial nesting seabirds; and some wetlands were created on the western side of Big Island (Figure 3).

In 1987, at the request of the Louisiana Department of Wildlife and Fisheries (LDWF) and the U.S. Fish and Wildlife Service (FWS), the New Orleans District began placement of dredged material on the east side of the navigation channel in an effort to stimulate growth of the east side of the delta. Disposal plans developed in coordination with the LDWF, FWS, and other state and Federal natural resources agencies, were designed to direct sediment-laden water through existing natural channels, i.e., God's Pass, East Pass, Ratcliffe Pass, to the east side of the delta. In general, dredged material was to be placed as a series of mounds on the eroding subaerial levees of existing delta lobes and on the heads of islands at existing channel bifurcations. The maximum initial height of the dredged material mounds was +5.0 feet Mean Low Gulf (+4.2 Mean Sea Level). The mounds of dredged material would re-furbish the subaerial levees which would direct flows into the desired locations within the developing delta. During high flow events, the re-furbished levees would be over-topped and sediment-laden waters would drop sediment behind them at elevations suitable for the establishment of fresh marsh (+2.3 feet Mean Low Gulf) and/or submerged aquatic vegetation. The re-furbished levees also would protect the developing wetlands from wave-induced erosion.

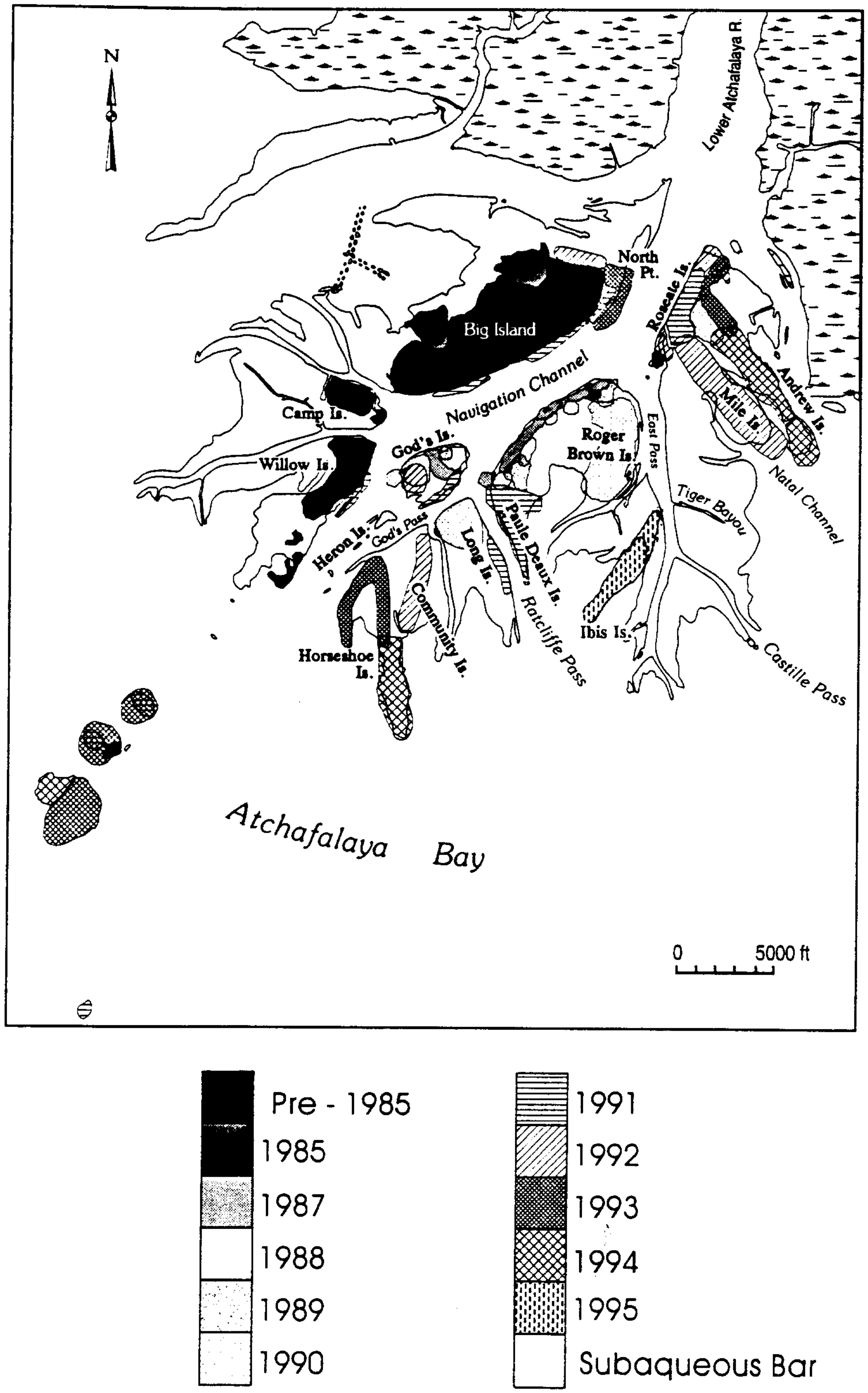


Figure 3. Dredged material disposal history for the Lower Atchafalaya River Bay and Bar navigation channel through 1996. 1985 to 1990 data from Van Heerden, 1994; 1991 to 1996 data from USACE -NOD *as-builts*.

In accordance with the plan during maintenance events in 1987, 1988, 1989, and 1990, in the upper bay/delta, dredged material was placed on the eroded subaerial levees of Roger Brown Island, Paule Deaux Island, and Roseate Island and on the heads of God's Island and Long Island. In the lower bay/delta, dredged material was used to maintain and construct islands for colonial nesting seabirds on the west side of the navigation channel. The initial height of the dredged material for bird island creation was +6.0 feet Mean Low Gulf (+5.2 Mean Sea Level).

By 1991 it became obvious that the re-furbished levees were not being over-topped during high flow events. At the request of the LDWF, the maximum initial height of the dredged material was changed to +3.78 feet Mean Low Gulf (+3.0 Feet Mean Sea Level). Dredged material from the 1991 maintenance event was placed along the banks of the navigation channel on the east side of Big Island, on both sides of God's Island and Heron Island and on the banks of East Pass and Ratcliffe Pass. Dredged material also was placed behind previously re-furbished levees on Paule Deaux and Roger Brown Islands, Long Island, and Roseate Island at an initial elevation of +2.78 feet Mean Low Gulf (+2.0 feet Mean Sea Level). Islands for colonial nesting seabirds were constructed and/or maintained with dredged material from the lower bay/delta.

Beginning with the 1992 maintenance event and in coordination with LDWF, FWS and other natural resources agencies, the dredged material disposal plan was modified to incorporate use of dredged material from the upper bay/delta to construct artificial delta lobes. The disposal plan developed was designed to direct flows between the lobes and to provide protected, shallow, open water areas within the lobes for the development of fresh marsh and submerged aquatic vegetation. During the 1992 maintenance event, the maximum initial height of the dredged material in that portion of the artificial delta lobes paralleling the channel was +4.0 feet Mean Sea Level/National Geodetic Vertical Datum (+4.78 feet Mean Low Gulf); the maximum initial height of the dredged material in that portion of the delta lobes perpendicular to the channel was +3.0 feet Mean Sea Level/National Geodetic Vertical Datum (+3.78 feet Mean Low Gulf). Both Mile Island and Community Island were constructed during the 1992 maintenance event. Islands for colonial nesting seabirds were constructed with dredged material from the lower bay/delta.

During the 1993 maintenance event, the maximum initial height of the dredged material for creation of the artificial delta lobes was +4.0 feet Mean Sea Level/National Geodetic Vertical Datum (+4.78 feet Mean Low Gulf) for all portions of the lobes. Construction of Andrew Island and Horseshoe Island commenced during the 1993 maintenance event and continued during the 1994 maintenance event. Dredged material also was placed at North Point and on God's Island during the 1993 maintenance event. Islands for colonial nesting seabirds were constructed with dredged material from the lower bay/delta during both 1993 and 1994, and were enlarged in 1995 and 1996. In 1995, a new delta lobe was created on the east side of the delta off of East Pass. Named Ibis Island, the bare, sandy formation was quickly claimed by nesting birds.

In the bar channel between 1974 and 1991, all of the dredged material removed during routine maintenance was placed in an interim designated ocean dredged material disposal site (ODMDS) located on the east side of the navigation channel. Beginning with the 1991 maintenance event, dredged material suitable for stacking from the upper reach of the bar channel has been placed into an open water disposal area on the east side of the channel in a manner conducive to bird island construction and the material not suitable for stacking has been placed into the ODMDS.

FIELD SURVEY RESULTS

Methodology

Elevation Profile Surveys

Andrew Island, Horseshoe Island, and Ibis Island were selected for the long-term field monitoring sites in the Atchafalaya River bay and bar (Figure 4). Both Andrew Island and the eastern lobe of Horseshoe Island were constructed during the 1994 maintenance event. Ibis Island was constructed during the 1995 maintenance event.

The collection of survey profiles were made in two phases. Phase-I involved assessing the characteristics of each site to determine the most applicable position to setup a long-term monitoring program that would best document habitat evolution. This was accomplished using vertical aerial photography, reviewing dredging schedules and history, ground truthing each site, and defining varying vegetation and site morphology. Based on these factors, three series of stakes (two groups of four stakes, and a single southern most stake) were positioned along the longitudinal axis (crest) of Andrew Island, eastern Horseshoe Island, and Ibis Island. Permanent 1-inch diameter by 6-foot galvanized stakes were driven approximately 3.5-feet into the ground and secured with concrete. The stakes in each group at Horseshoe and Andrew islands were positioned 200-feet apart, and at Ibis Island 1000 feet apart, and were defined spatially using a Global Positioning System (GPS).

Phase-II involved the actual collection of profile datum. Survey datum were collected using a Topcon GTS-300$_{DPG}$ Total-Station, tri-prism, and TDS48 Data Collection System. The horizontal accuracy of the GTS-300 is 0.25 ft ± 0.0125 ft., and has a vertical accuracy of 0.45 ft ± 0.0125 ft. The maximum horizontal range with tri-prism is 3,525 ft. A Pathfinder Professional MC-5 global positioning system (GPS) device was used to record the horizontal positions of each stake, instrument location, and the position and exact orientation of each transect line. The transect datum collected were processed, referenced to local benchmarks (Figure 4) or tide gage at Point au Fer, and entered into a graphic software program to produce topographic profiles.

In April of 1995, nine lateral (perpendicular to island crest) profile transects were collected from both Andrew and Horseshoe islands. In October 1996, the transects at Andrew Island and Horseshoe Island were re-surveyed to determine change since 1995, and a new transect network was established at Ibis Island. Ibis Island was constructed during the 1995 maintenance dredging event and provided a new opportunity to document geomorphic and vegetative processes controlling landscape development.

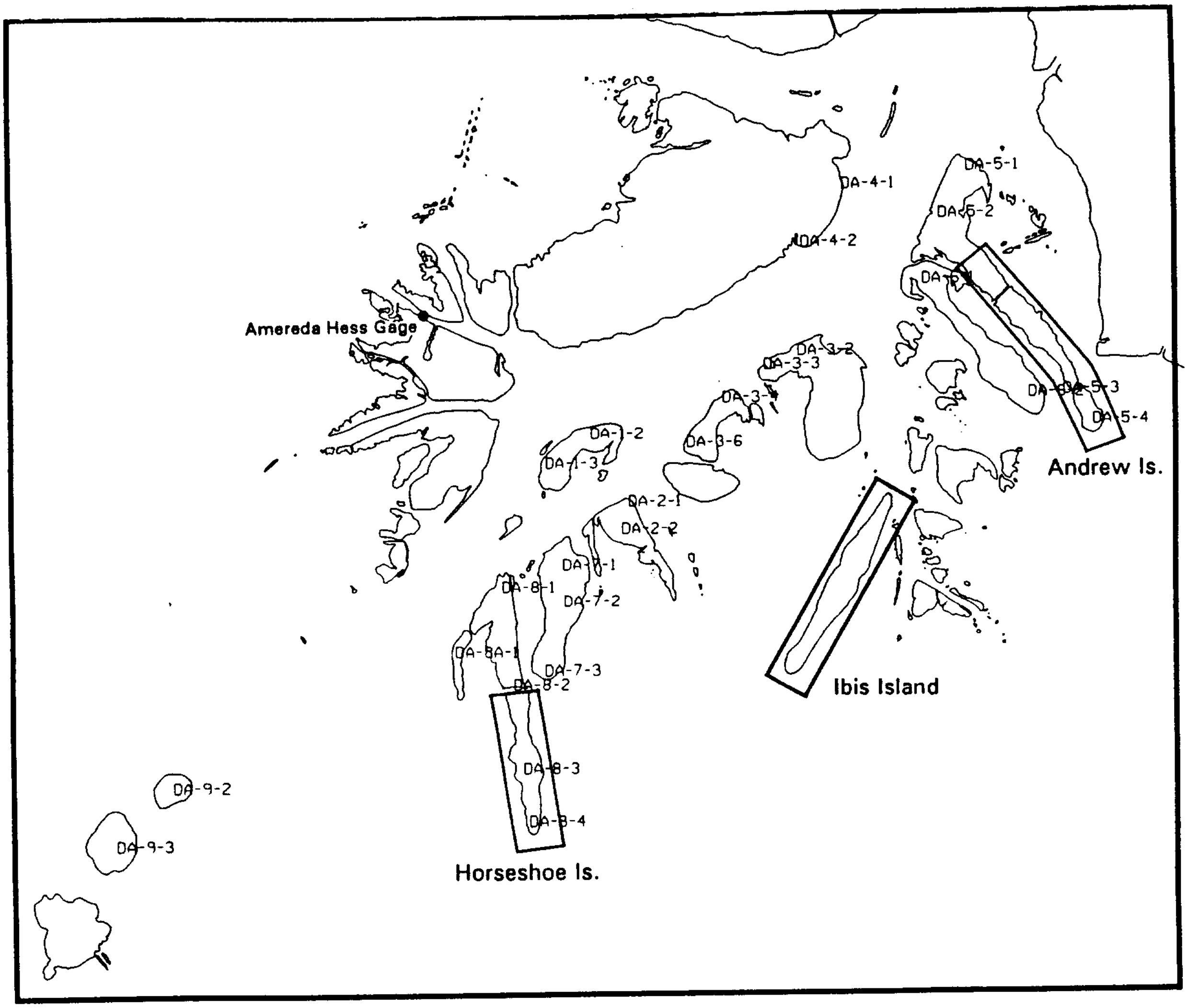


Figure 4. Location of Andrew Island, Horseshoe Island, and Ibis Island BUMP study sites, and the benchmarks available to reference the elevation data at the Atchafalaya River Bay and Bar delta.

Vegetation Surveys

Ground truthing for vegetative species composition and habitat verification of Andrew Island and eastern Horseshoe Island was done in April of 1995 and October 1996. Ground truthing for vegetative species composition and habitat verification of Ibis Island was done in July 1996. Species composition was determined within an approximate six- foot swath along each profile, and boundaries between vegetative communities were entered as points on the elevation profile. No submerged aquatic species were considered for this report. Plants were identified in the field with only representative specimens taken for confirmation by taxonomic keys and/or verification by the LSU Department of Plant Biology. The better specimens, and uncommon specimens were entered into the LSU herbarium collection; all others were archived by the author. The percent composition of each species was visually estimated in order to determine the relative abundance and dominance of species for habitat determinations. These percentages were not intended to provide scientific ratios or statistics. The *list of vegetative species* was compiled of all species observed and/or collected along the study and includes habitat preferences of each (Appendix 9A). This list is not complete; it reflects only those species that were readily observed and identified during the profiling period. Some plants can only be identified during a short flowering period which may not have occurred at the time of the profile, and therefore can not be included in the list other than by a broad classification.

Detailed plant identification was performed on the initial set of profiles for a new area to establish plant community/habitat types for ground truthing. Thereafter, plant identification is more for updating the vegetation list. Therefore, detailed vegetation data was collected for Andrew and Horseshoe islands in 1995 and was reported in the 1995 Final Report. Ibis Island was new for 1996 and detailed vegetation data was collected in 1996 and is included in this report.

Profiles

The field monitoring area included three very long spits created by dredged material deposition; Andrew Island at the north end of the Atchafalaya delta, Ibis Island at the central area, and the eastern lobe of Horseshoe Island at the south end. Initially, a matrix of 10 elevation profiles was established at each spit, and vegetation was recorded for each profile. The profile matrix at each island consists of three sections each, labeled 3-0 to 3-3 for the channel section, 2-0 to 2-3 for the middle section, and 1-0 to 1-1 for the distal end. Sample profiles were selected to show the general distribution of the vegetation or habitats in relation to the elevation profiles. The profile elevations were taken during a period of high water for the Atchafalaya delta.

Andrew Island

Andrew Island is located along the northeastern side of the Atchafalaya River delta (Figure 4). Figure 5 is a schematic diagram of the arrangement of profile transects. Five of the ten topographic profiles for Andrew Island were selected to be representative of the area based on the data collected in 1995 and were repeated in 1996. A comparison of the data collected in 1995 and 1996 shown in Figure 6 reveals an interesting pattern of compaction, aeolian transport, sediment accretion and overwash processes for Andrew Island in cross section.

Profiles here range in lateral length from 790 to 1450 feet. The first series of stakes (I) located at the southern tip of Andrew Island has a maximum relief of 4.47 feet, with an average relief of 2.33 feet. The 2nd series of stakes (E-H) along the crest has a maximum average relief of 4.23 feet, with an average relief of 2.20 feet. The 3rd series of stakes (D-D') has a maximum average relief of 4.27 feet, with an average relief of 3.08 feet.

The profiles were typically more vegetated at the lateral ends (intertidal zone) of each profile, and generally decrease in density with an increase in elevation. Vegetation increased in density since the date of the last profile, some bare areas have been colonized, and habitats have become more established or shifted as the elevation has varied over time. Sample profiles selected to show the general distribution of the habitats in relation to elevation in 1995 and 1996 are shown for comparison in figures 7 and 8. The island crest was generally composed of bar aeolian type sand features (ripples and dunes).

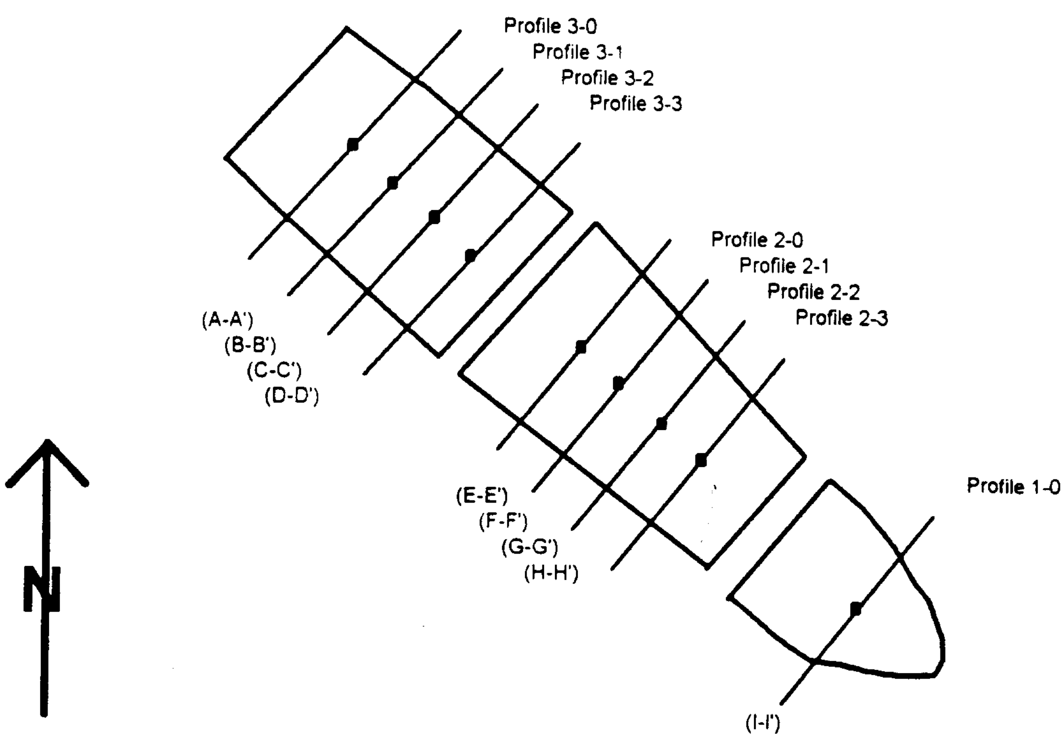
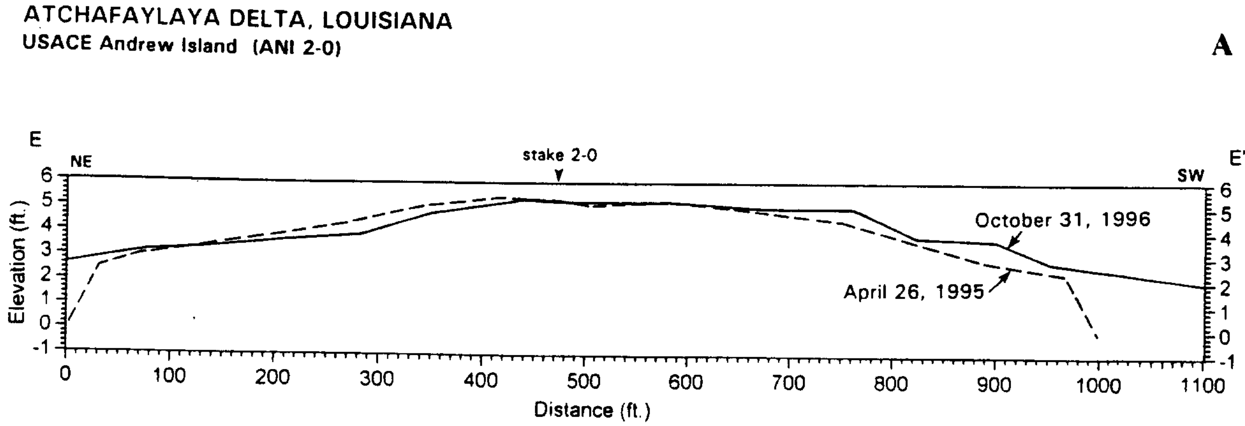
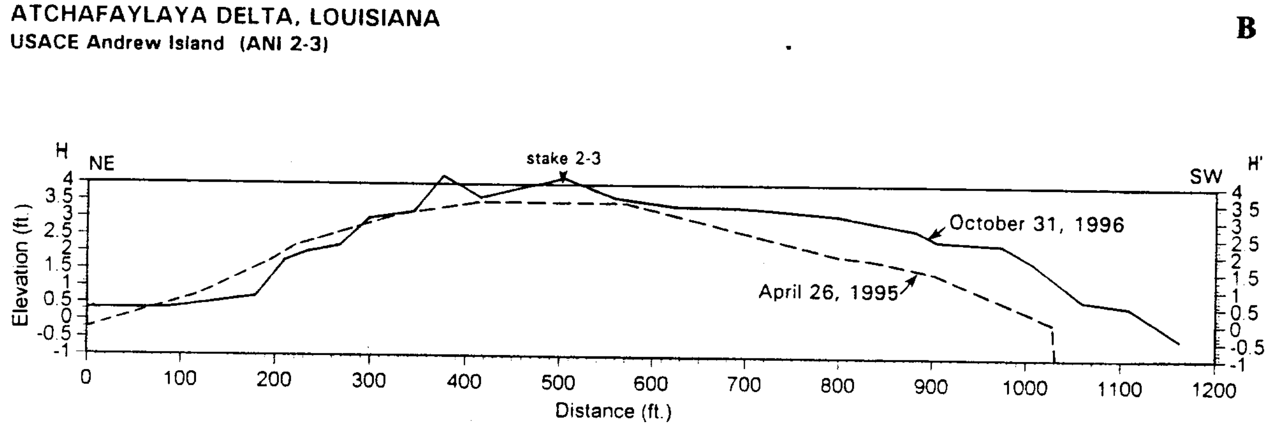


Figure 5. A schematic diagram of the BUMP profile locations and configurations for Andrew Island in the Atchafalaya River delta.





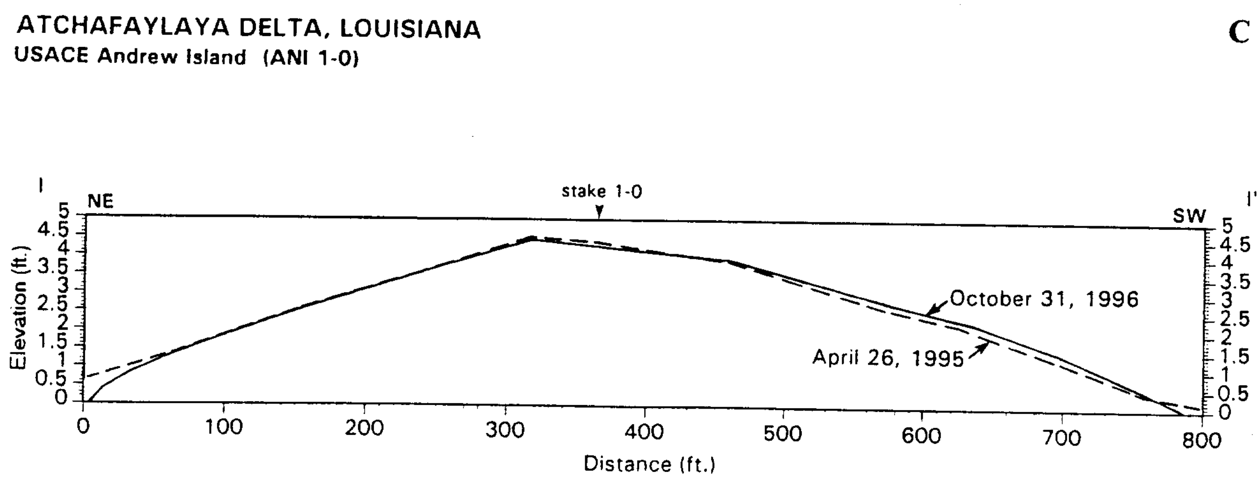
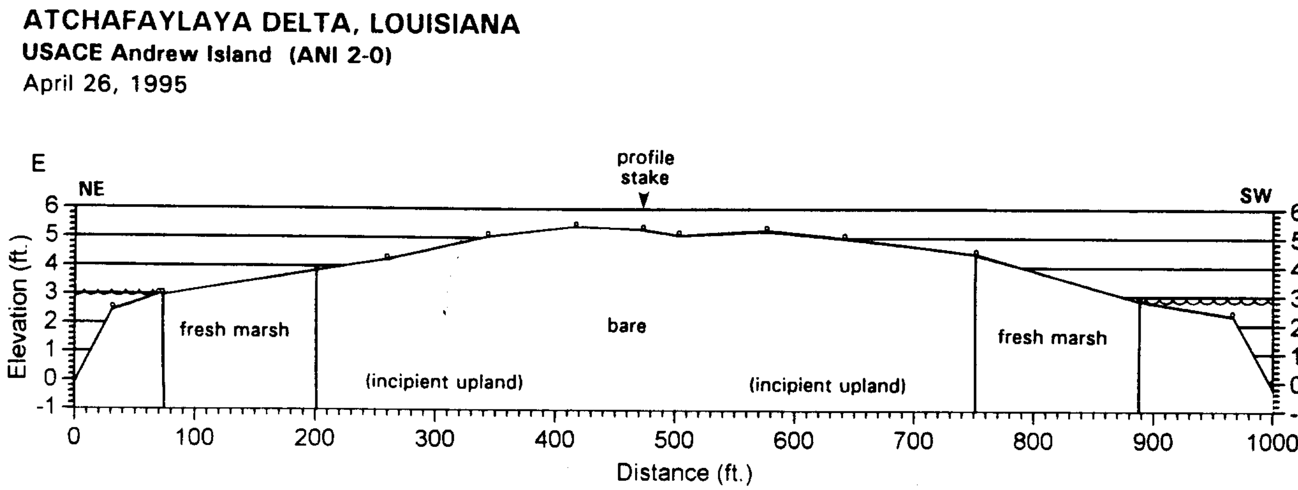


Figure 6. A comparison of 1995 and 1996 elevation data at Andrew Island in the Atchafalaya River delta. A) Profile E-E' at stake 2-0.B) Profile H-H' at stake 2-3. C) Profile I-I' at stake 1-0.

A



B

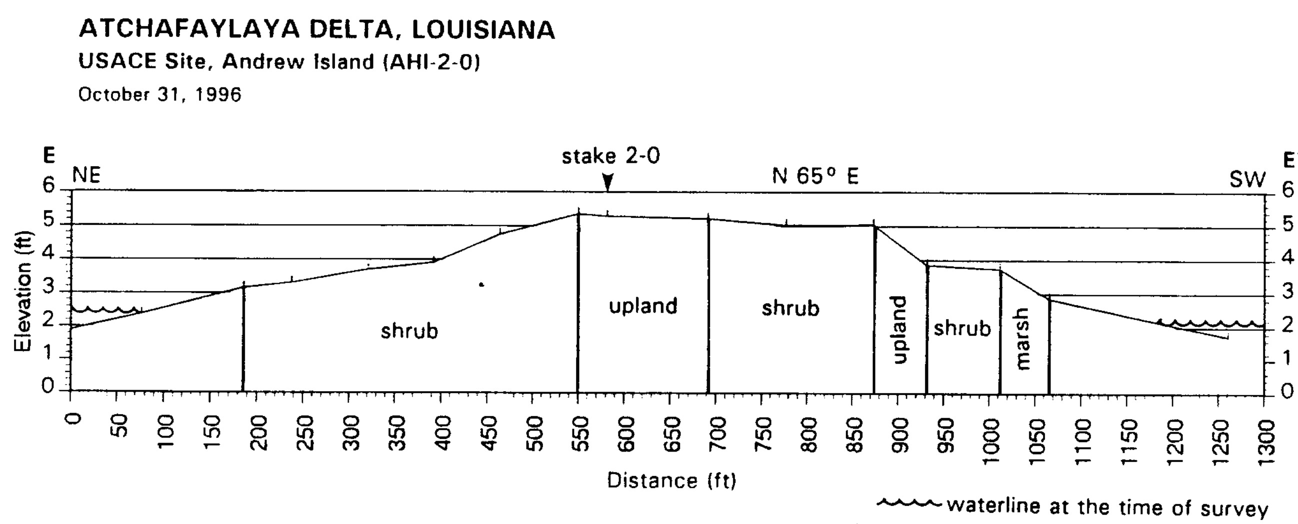
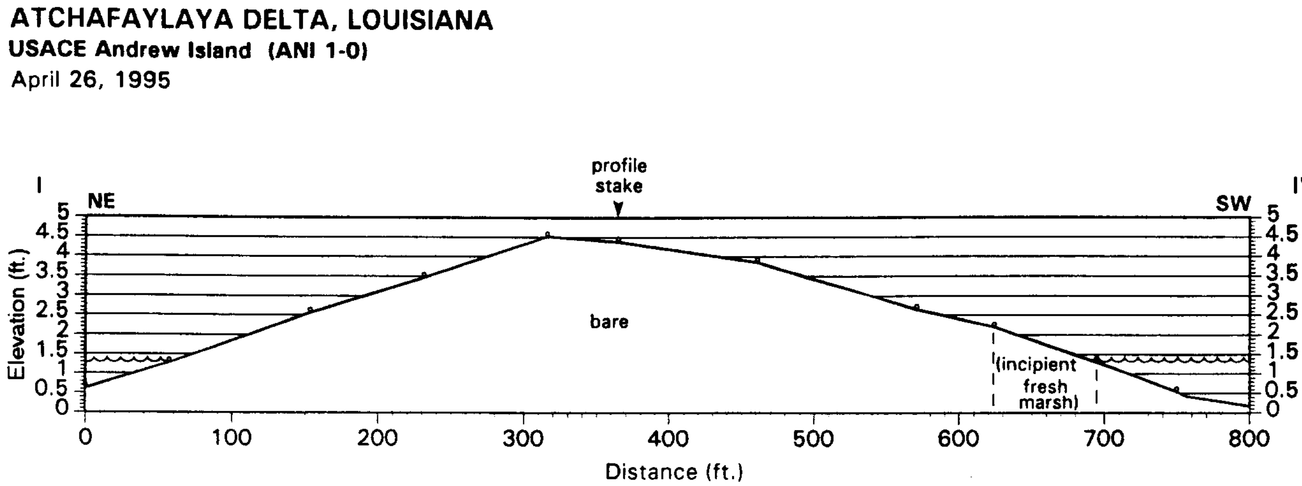


Figure 7. Elevation profile ANI 2-0 from Andrew Island in the Atchafalaya River delta showing habitat distribution change. A) 1995 data. B) 1996 data.

A



B

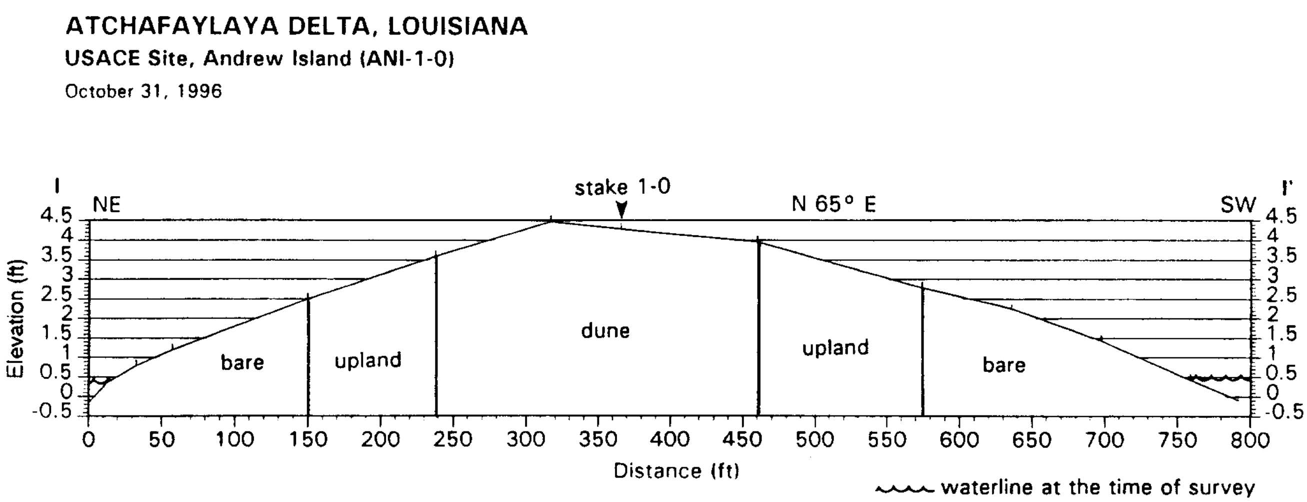


Figure 8. Profile ANI 1-0 from Andrew Island in the Atchafalaya River delta showing habitat distribution changes. A) 1995 data. B)1996 data.

Horseshoe Island

Horseshoe Island is located along the southeastern side of the Atchafalaya River delta and is composed of two lobes (Figure 4). Figure 9 is a schematic diagram of the arrangement of profile transects. These nine topographic profiles were constructed from the data collected in reference to the U. S. Army Corps of Engineers benchmarks #DA-8-3 and #DA-8-4. A comparison of the data collected in 1995 and 1996 shown in Figure 10 reveals a pattern of compaction, aeolian transport, sediment accretion and overwash processes for Horseshoe Island in cross section.

Profiles here range in lateral length from 1045 to 1445 feet. The first series of stakes (I-J) located at the southern tip of eastern Horseshoe Island has a maximum average relief of 3.09 feet, with an average relief of 2.17-feet. The 2nd series of stakes (E-H) along the crest has a maximum average relief of 3.41 feet, with an average relief of 1.78 feet. The 3rd series of stakes (A-D) has a maximum average relief of 3.76 feet, with an average relief of 2.60 feet.

The profiles were typically vegetated at the lateral ends (intertidal zone) of each profile, and generally decrease in density with an increase in elevation. Sample profiles selected to show the general distribution of the habitats in relation to elevation in 1995 and 1996 are shown for comparison in figures 11 and 12. The island crest was generally composed of bar aeolian type sand features (ripples and dunes).

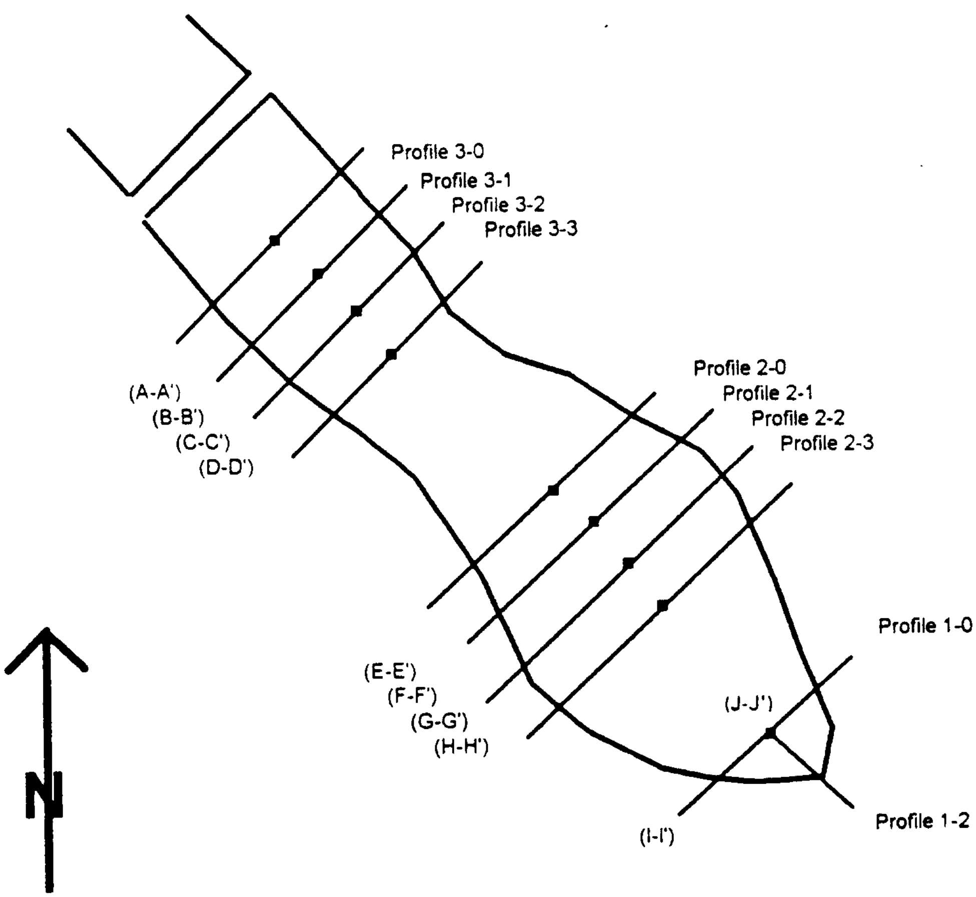
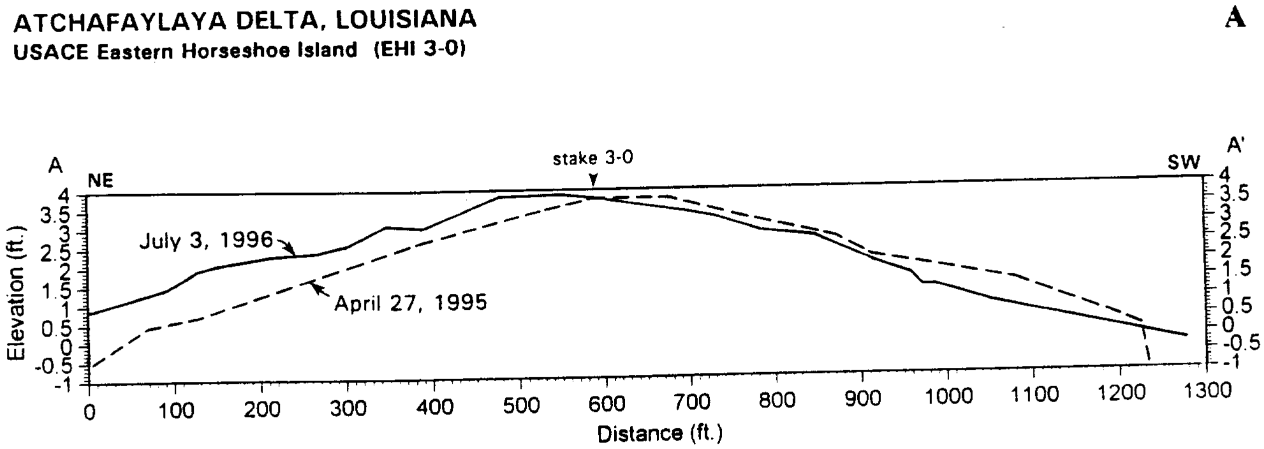
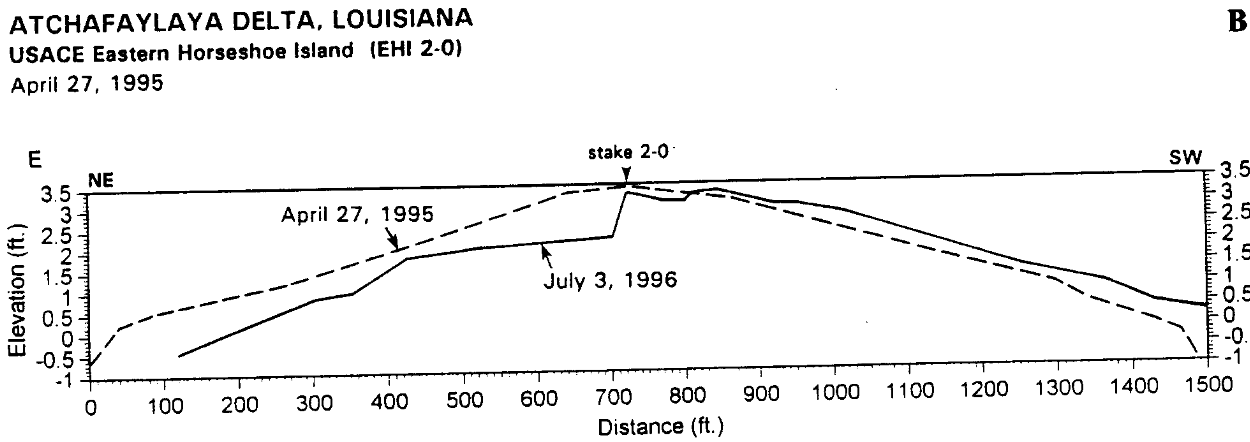


Figure 9. Schematic diagram of the BUMP profile locations and configurations for the eastern lobe of Horseshoe Island in the Atchafalaya River delta.





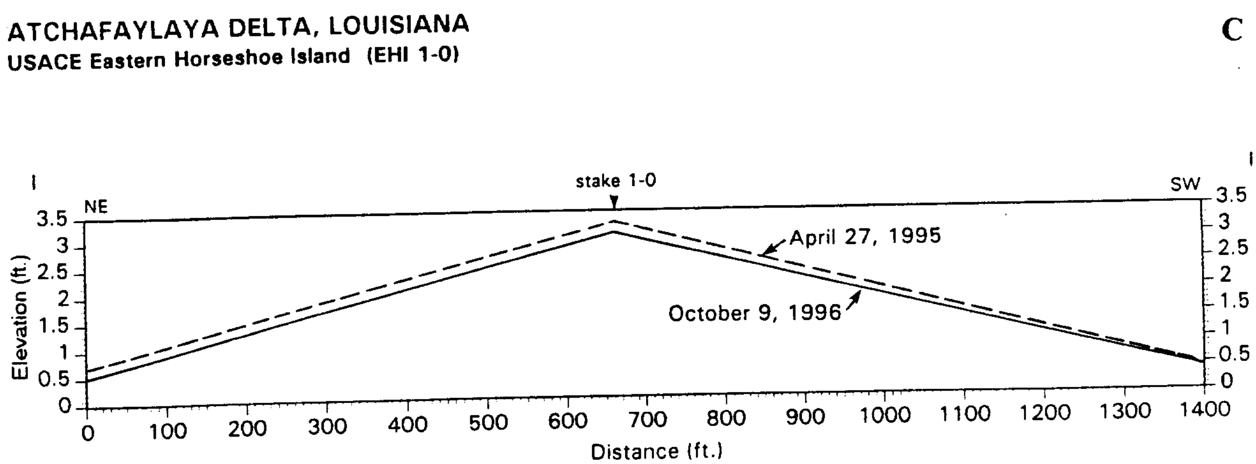
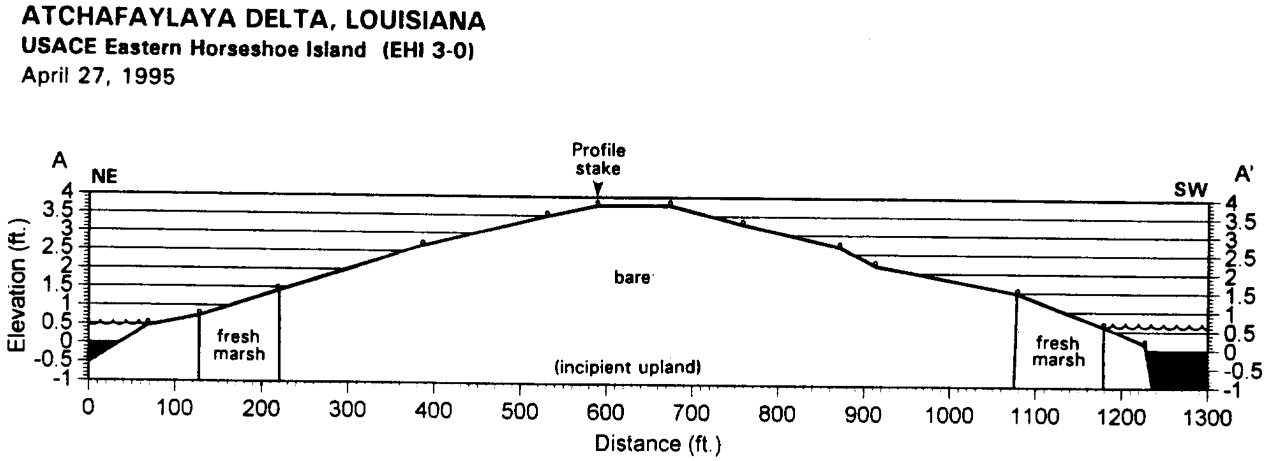


Figure 10. A comparison of 1995 and 1996 elevation data at Horseshoe Island in the Atchafalaya River delta. A) Profile A-A' at stake 3-0. B) Profile E-E' at stake 2-0. C) Profile I-I' at stake 1-0.

A



B

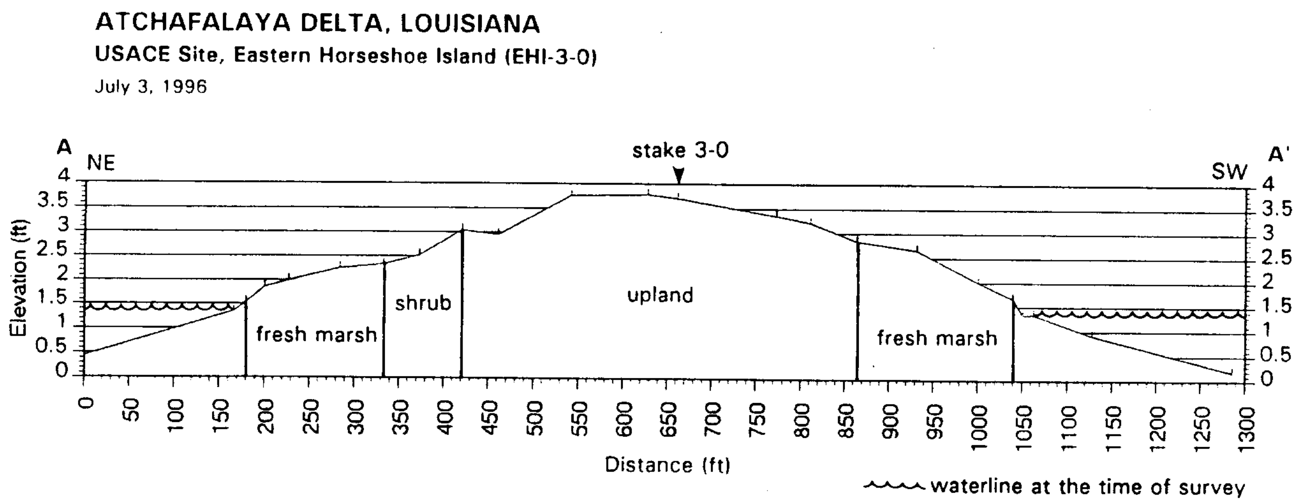


Figure 11. Elevation profile EHI 3-0 from Horseshoe Island in the Atchafalaya River delta showing habitat distribution changes. A) 1995 data. B) 1996 data.

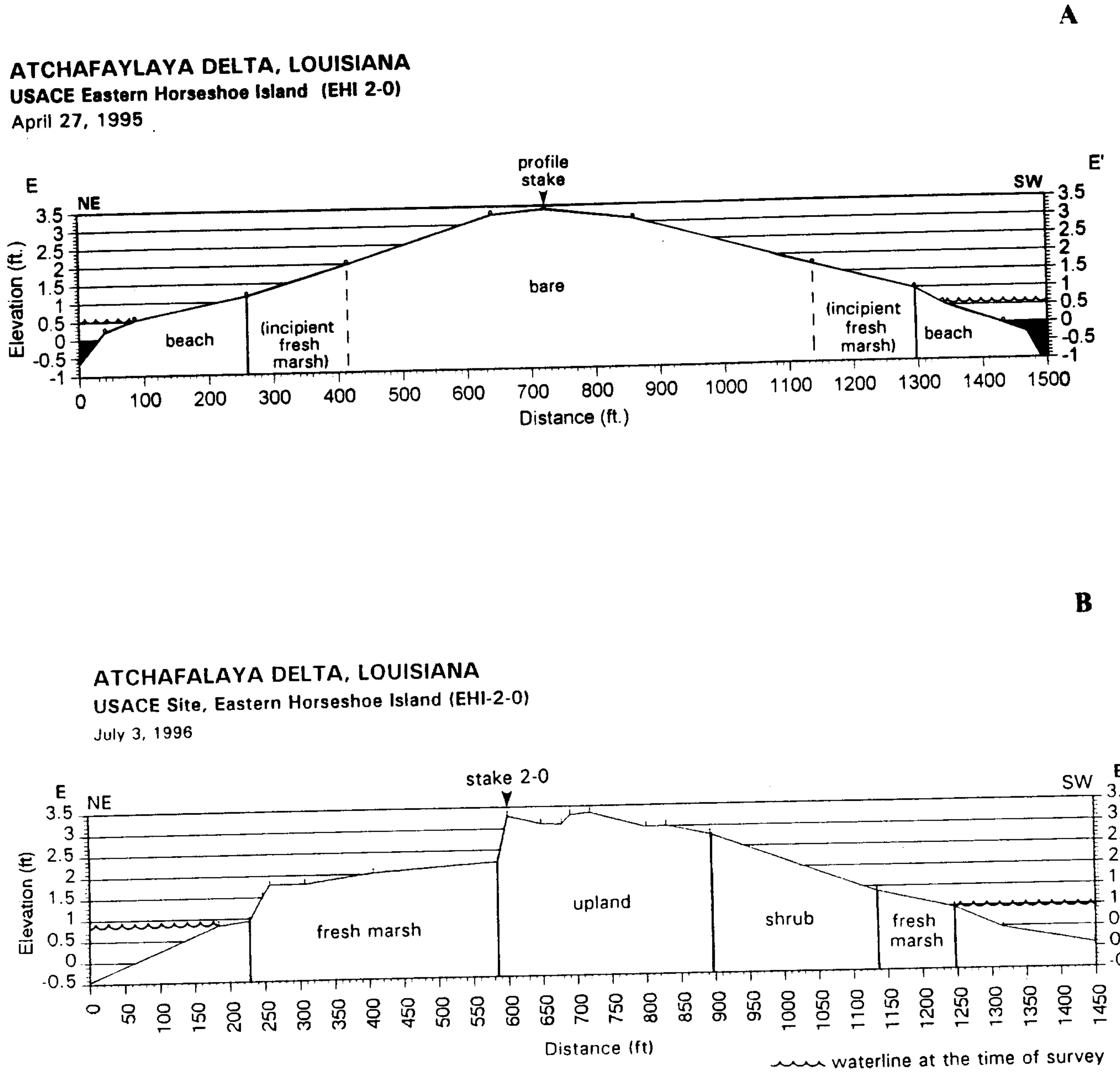


Figure 12. Elevation profile EHI 2-0 from Horseshoe Island in the Atchafalaya River delta showing habitat distribution changes. A) 1995 data. B) 1996 data.

Ibis Island

Ibis Island is located along the east-central side of the Atchafalaya River Bay and Bar delta (Figure 4). This artificial delta lobe was constructed during the USACE-NOD FY1995 maintenance event.

Nine topographic profiles were constructed from the data collected in reference to the tide gage for Point Au Fer, Louisiana. Figure 13 is a schematic diagram of the arrangement of profile transects. Profiles here range in lateral length from 921 to 1237 feet. The first series of stakes (A-B) located at the southern tip of eastern Ibis Island has a maximum average relief of 3.89 feet, with an average relief of 2.14 feet. The 2nd series of stakes (C-E) along the central portion of the island has a maximum average relief of 4.09 feet, with an average relief of 2.42 feet. The 3rd series of stakes (E-H) on the portion of the island near East Pass has a maximum average relief of 2.89 feet, with an average relief of 2.08 feet.

The island was created approximately one year before the survey profile elevation and vegetation data was collected and vegetation ccolonization was well under way. The profiles were typically vegetated at the lateral ends (intertidal zone) of each profile, and generally decrease in density with an increase in elevation. Sample profiles selected to show the general distribution of the vegetation in relation to the elevation profiles are shown in figures 14, 15, and 16. The majority of the island was generally composed of extensive bar aeolian type sand features (ripples and dunes).

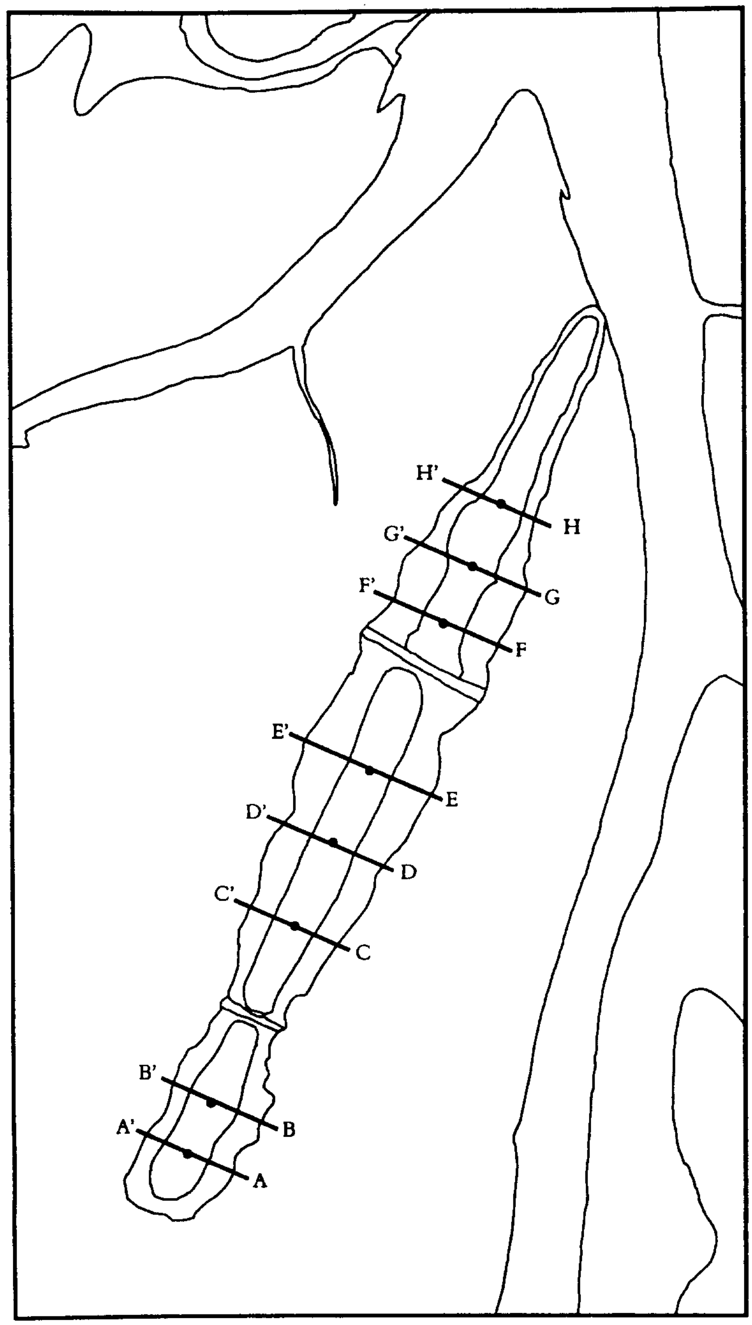


Figure 13. Schematic diagram of the BUMP profile locations and configurations for Ibis Island in the Atchafalaya River Bay and Bar delta.

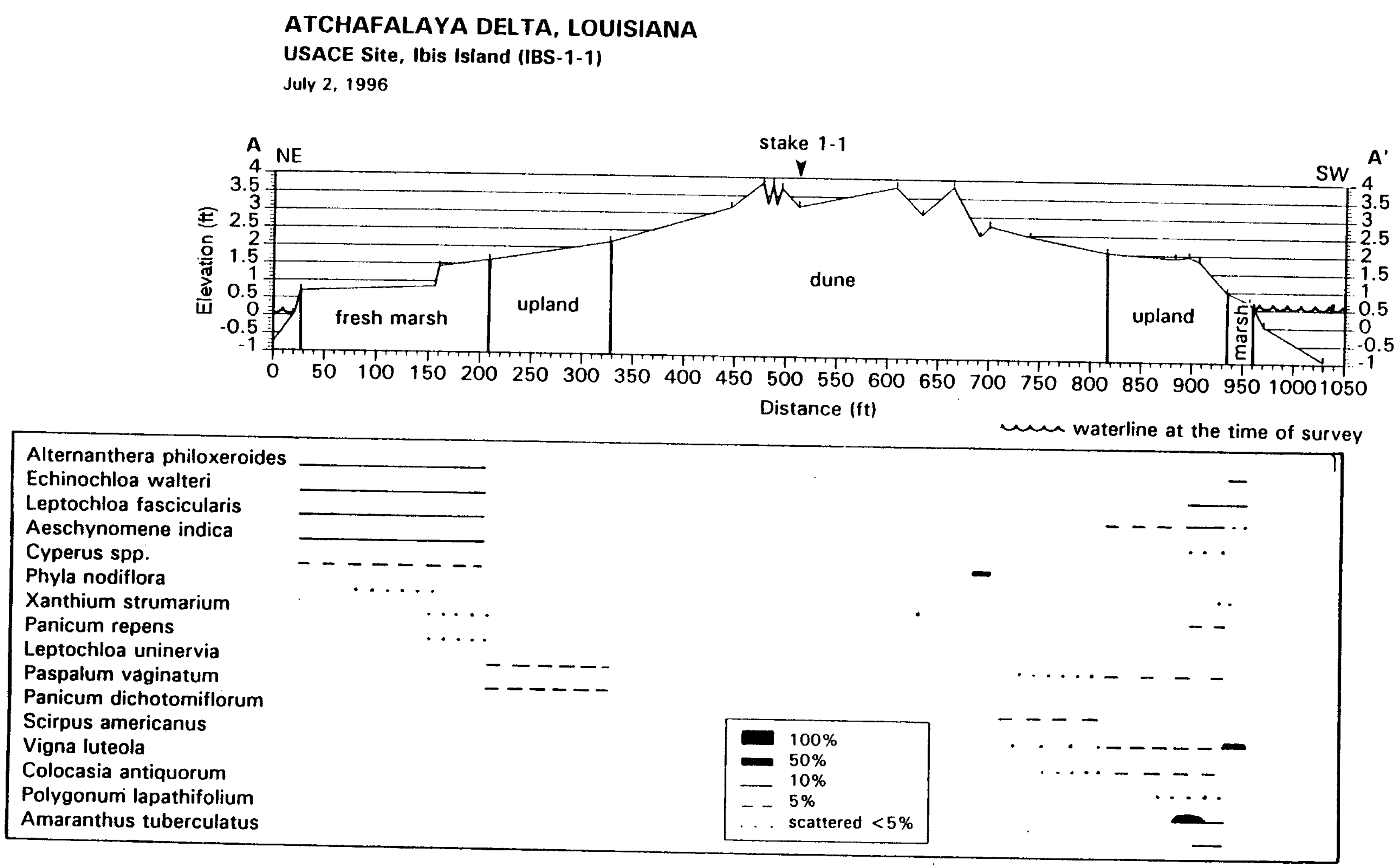


Figure 14. Profile IBS 1-1 from Ibis Island in the Atchafalaya River delta.

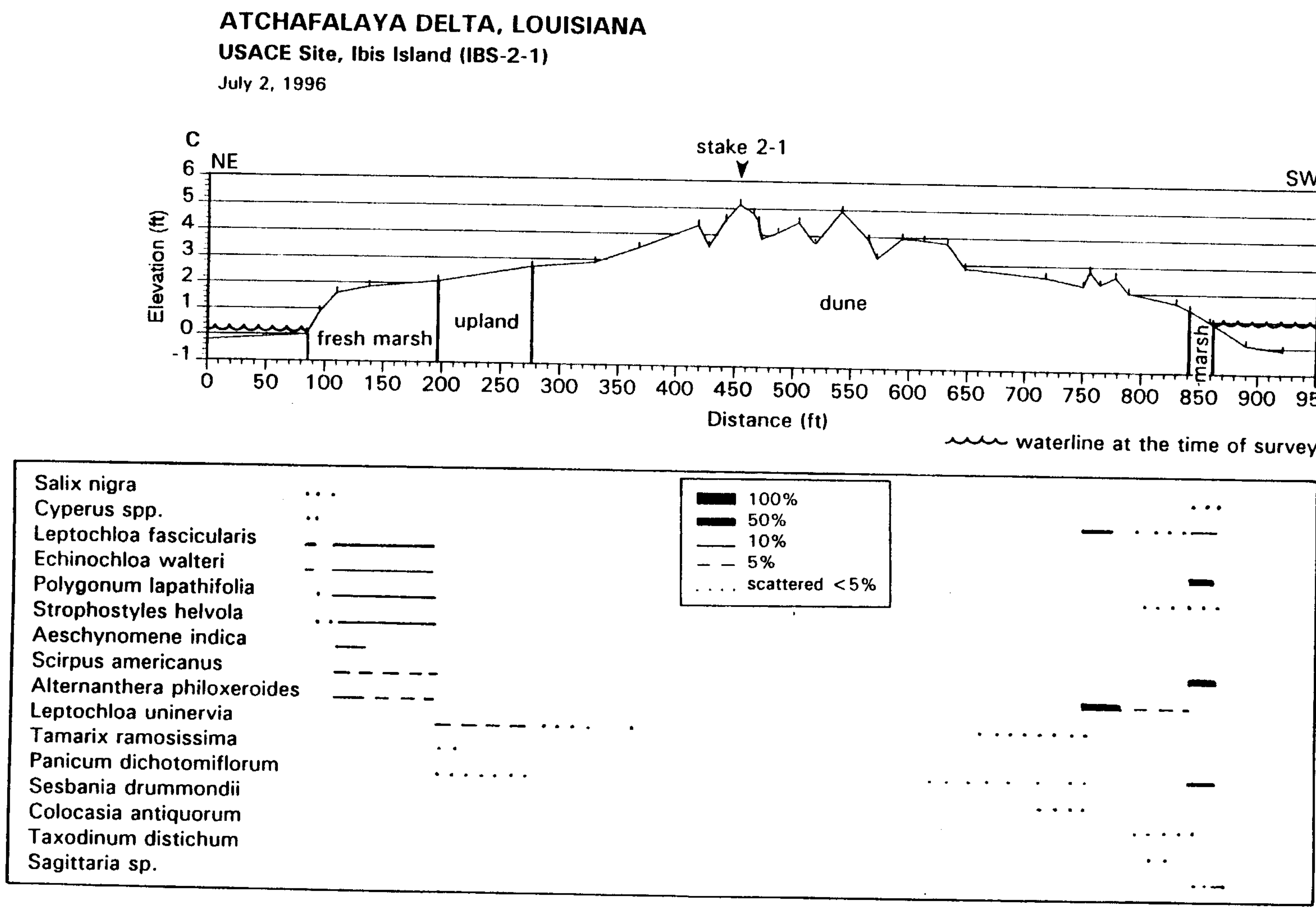


Figure 15. Profile IBS 2-1from Ibis Island in the Atchafalaya River delta.

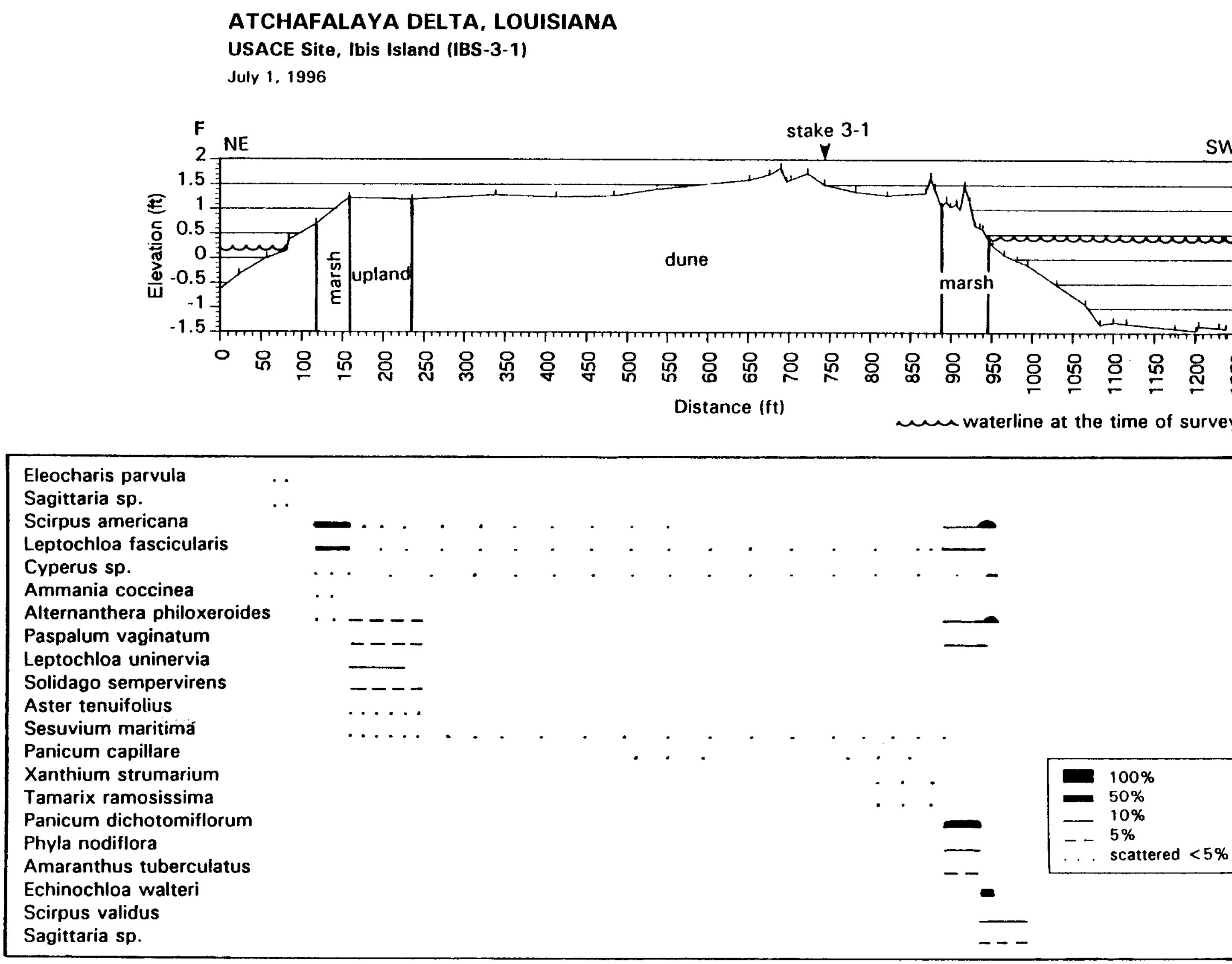


Figure 16. Profile IBS 3-1 from Ibis Island in the Atchafalaya River delta.

Vegetative Character

General Description

The delta within the Atchafalaya River Bay and Bar supports a freshwater dependant vegetation system. This is predominately fresh marsh, batture communities dominated by black willow, and upland/grassland habitats. The delta area is exposed to the daily tides as well as to elevated water levels during high river conditions. Source material for colonization is predominantly from the extensive Atchafalaya River swamp system that lies upstream from the dredged material disposal sites. Longshore drift or aeolian transport of some vegetative material could be expected from other nearby areas.

Each plant species has a habitat preference, and when taken as a community, the type of vegetation present is an indication of habitat type. Major changes in plant communities delineate boundaries between habitats. The study sites exhibited well-zoned colonization of vegetation with distinct wet areas and distinct dry/aeolian areas. A large, bare, central area flanked by grassland, shrubs, and then outlined with a marsh fringe was the common arrangement of habitats.

Vegetative Community Types in the Atchafalaya Delta

Most of the plants observed within the study sites at Andrew Island and Horseshoe Island are of riparian or wetland habits (See habitat descriptions in Appendix 9A). Other species are listed as occupying "disturbed" or "waste" places and are species that take advantage of newly created or exposed ground with rapid growth and can withstand some inundation by fresh water. Opportunistic species will occupy a new area quickly, but will eventually be replaced by plants most suited for long term survival in a specific habitat.

Marsh species within the study sites at Andrew Island and Horseshoe Island occurred most commonly at an elevation below 2 feet MSL. The fresh marsh was represented by predominantly high marsh or marsh-margin species *Scirpus* spp., *Cyperus* sp., *Ranunculus sceleratus*, *Polygonum lapathifolium*, *Rorippa palustris*, and *Senecio glabellus*. Fresh marsh dependent species such as *Sagittaria* sp. that compose low fresh marsh was insignificant or not present along the profiles in the study area. Young willow trees (*Salix nigra*) were present throughout, scattered in many areas of the marsh, along low energy beaches, or within the grasslands. Water hyacinth (*Eichhornia crassipes)* was found along the shore, rafted against the windward side and stranded thickly by a previous high water event.

Upland areas along the profiles within the study sites were represented by grasslands, embryonic dune terraces, and potential shrub/scrub. Grasses establish quickly on well-drained, freshly deposited materials and form grasslands that help to quickly stabilize the new material. *Leptochloa uninervia*, *Panicum repens*, and *Cynodon dactylon* tend to be the most common grass species, with *Cyperus elegans*, *Acnida tamariscina*, *Conyza bonariensis* as common herbaceous plants. Older deposits support additional species and the beginnings of shrub habitats with an understory of grasses.

Shrub communities usually indicate older, more stable, elevated areas. In the Atchafalaya area, this is almost exclusively *Salix nigra* or black willow. Since willows also forms a forested wetland habitat, shrub/scrub is not a good indicator of elevation in the delta, but does indicate stable areas. Young willows were profusely represented along most of the survey transects at Andrew and Horseshoe islands. *Baccharis halimifolia* was the only other significant shrub species found along the study profiles.

Willows (*Salix nigra*) at greater than 20 ft tall also constitutes the forested wetland habitat found on other areas of the delta. Willow establishes and grows rapidly in frequently inundated sandy areas, most often along riverbanks and battures. This habitat sometimes includes an understory of *Iris virginicus*, *Hymenocallis occidentalis*, *Colocasia antiquorum*, and *Senecio glabellus*.

Low wet areas within the upland areas of the study sites at Andrew and Horseshoe islands are being colonized by *Bacopa monnieri*, *Polygonum lapathifolium*, and tiny *Eleocharis parvula*.

GIS ANALYSIS RESULTS

Shoreline Changes: 1985-1996

Figure 17 graphs the spatial history of the Atchafalaya delta between 1970 and 1996. The area of the Atchafalaya delta in 1985 was measured at 1339.0 acres. The area of the Atchafalaya delta in 1996 was measured at 4445.2 acres. This is an area increase of +3106.2 acres or an increase in area of 232 percent. Figure 18 shows the shoreline change history of the Atchafalaya delta between 1985 and 1996. Between 1972 and 1985, the rate of area gain was about 100 acres per year. Since the shift of dredged material placement to the east side of the navigation channel with concomitant changes in placement techniques, the rate of growth has accelerated to about 350 acres per year.

The areas of greatest shoreline progradation are found east of the navigation channel. The shoreline has been pushed seaward up to 2 miles in some areas and averages about 1 mile. These measurements yield rates of shoreline progradation of 500 feet per year. These high rates of shoreline progradation are found mainly in areas of dredged material placement. West of the navigation channel in natural deltaic areas, the rate of progradation is much less and averages 0.5 miles. This yields a progradation rate of about 300 feet per year in areas of natural deltaic processes.

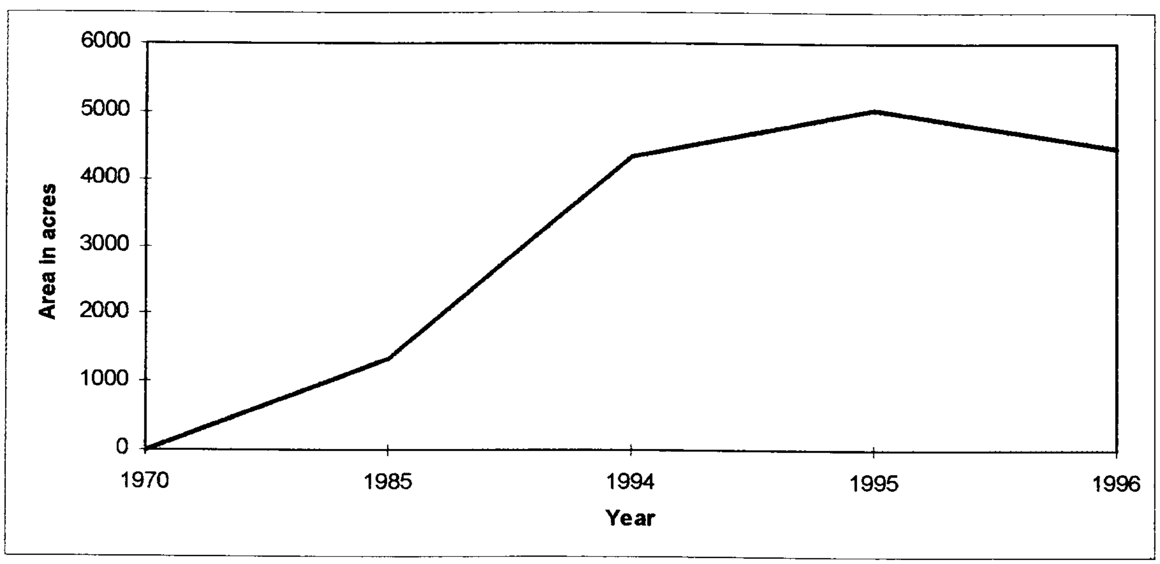
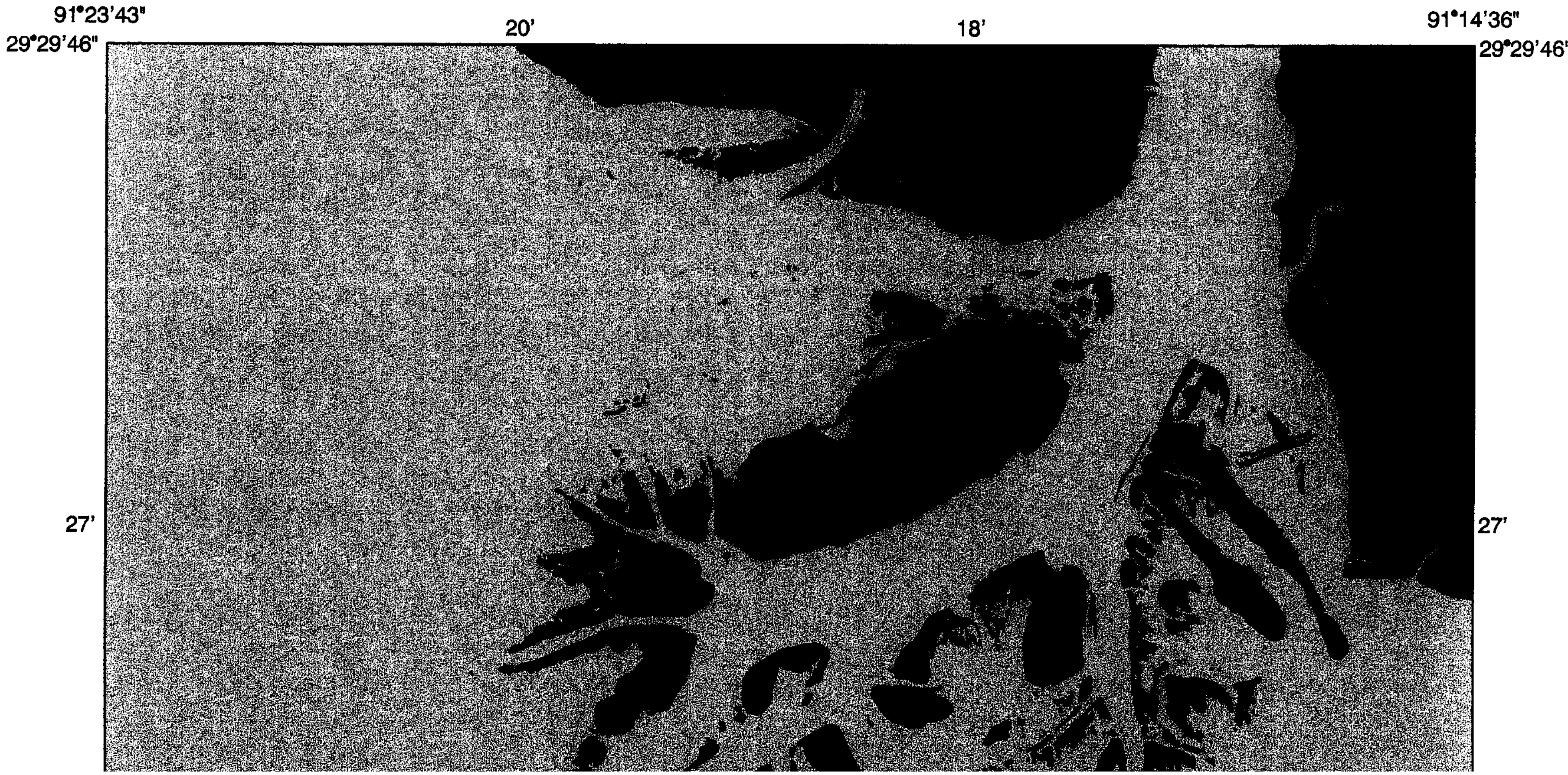
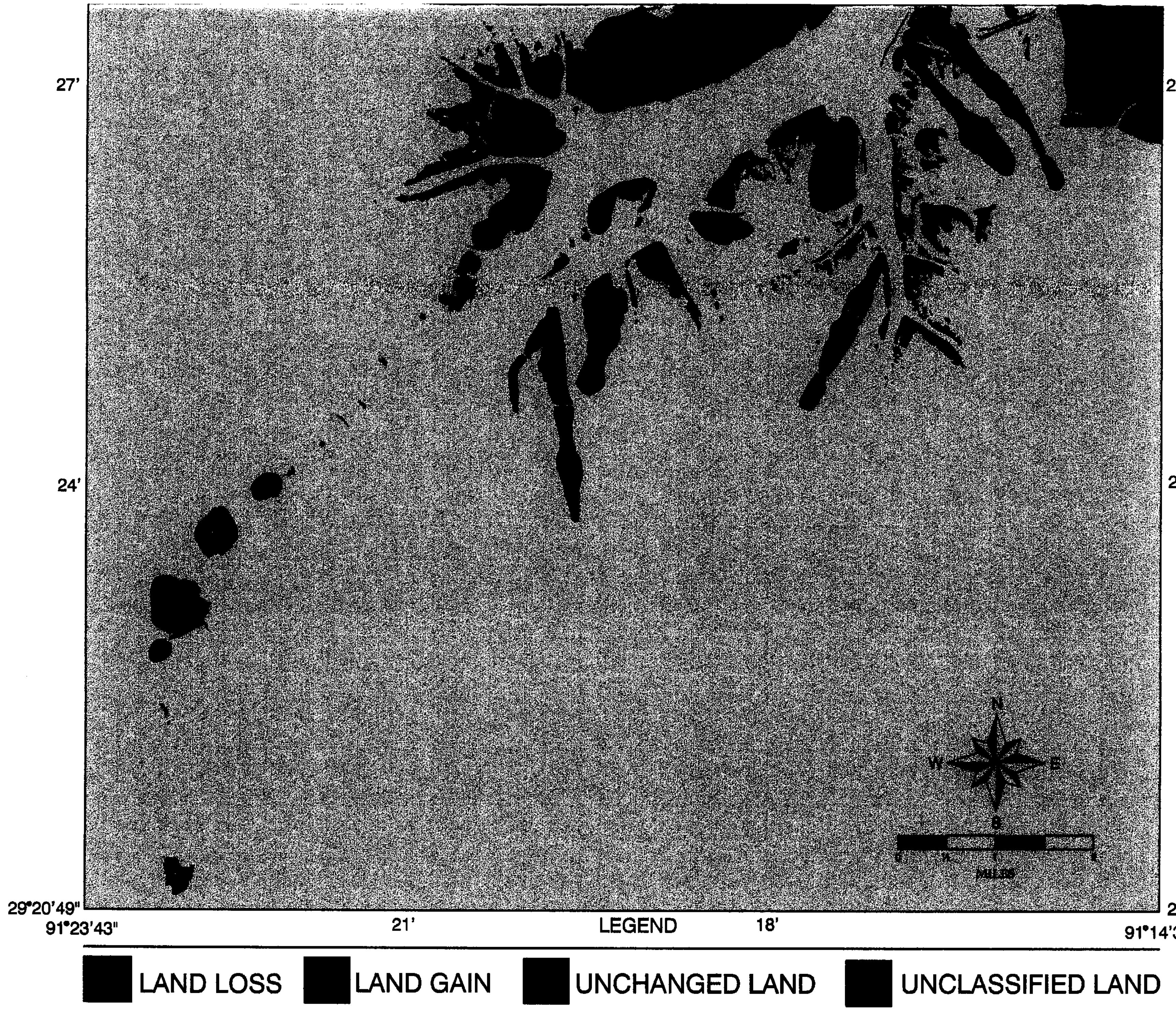


Figure 17. Graph of the area of the Atchafalaya delta over time.

ATCHAFALAYA DELTA 1985 - 1996




27'
27'
24'
24'
N
W
E
S
MILES
29°20'49"
91°23'43"
21'
LEGEND
18'
29°21'00"
91°14'37"
LAND LOSS
LAND GAIN
UNCHANGED LAND
UNCLASSIFIED LAND

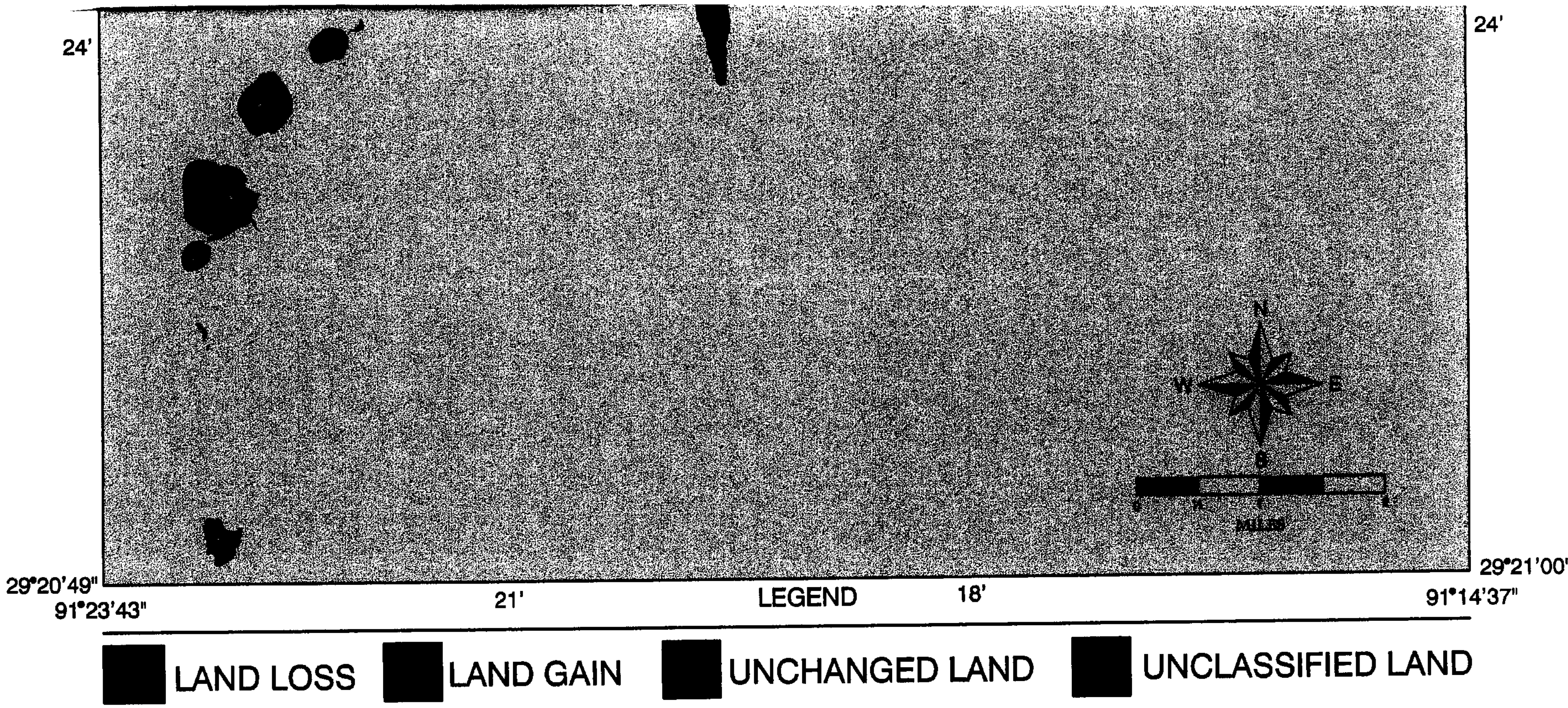


Figure 18. Land loss/gain map of the Atchafalaya River delta between December 1985 and November 1996.

Habitat Inventory

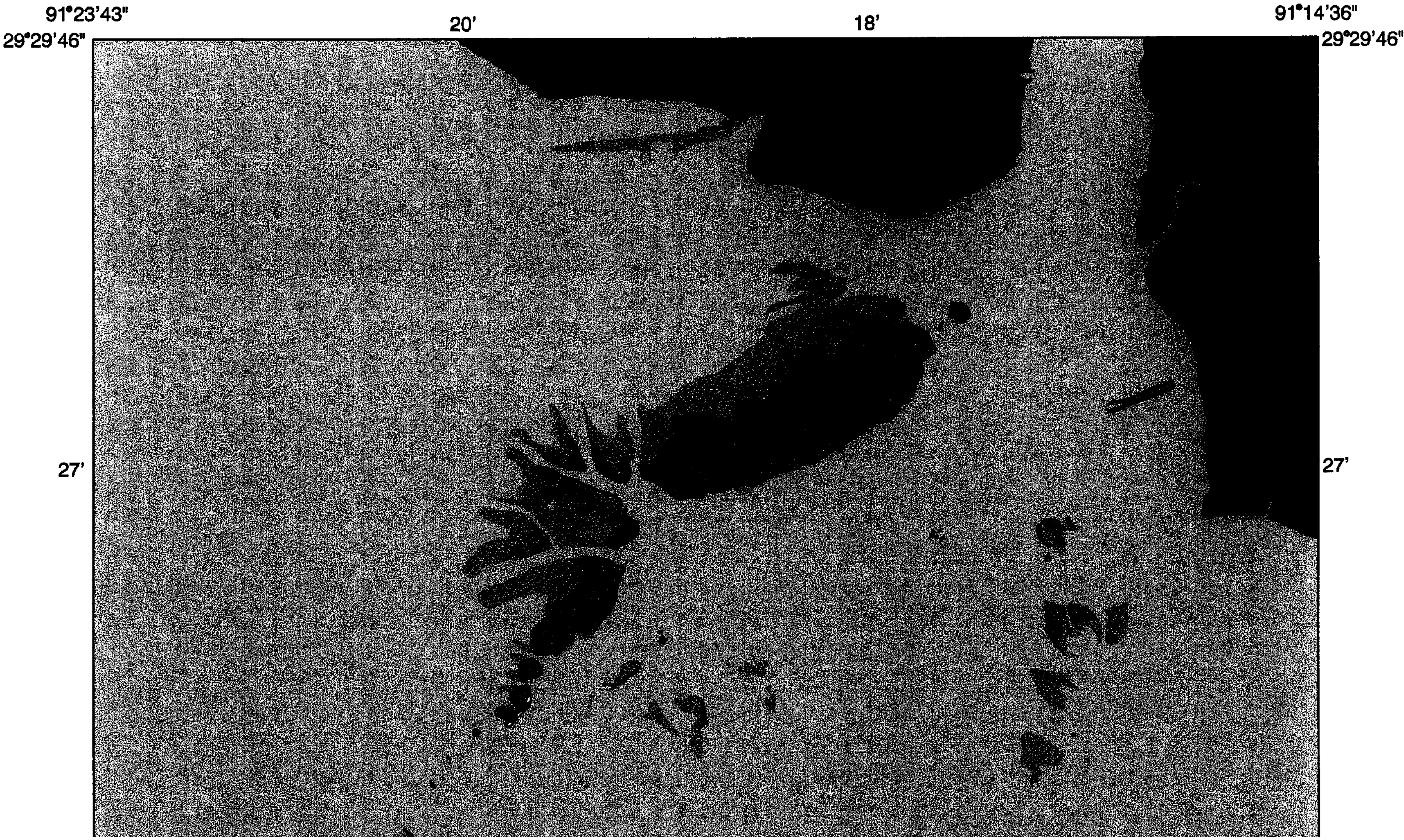
The aerial photographic interpretation combined with field surveys identified seven major habitat types in the Atchafalaya delta. These habitats are further classified as natural, BUMP man-made and non-BUMP man-made. The natural class identifies habitats created by natural deltaic processes. The BUMP man-made class (BUMP-made) identifies the habitats created by placement of dredged material. The Non-BUMP man-made class (other-made) separates areas created that were not part of the BUMP effort, such as areas created in association with the oil industry access and pipeline canals. Areas created indirectly by the beneficial use of dredged materials being re-worked by natural processes are included as natural. On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

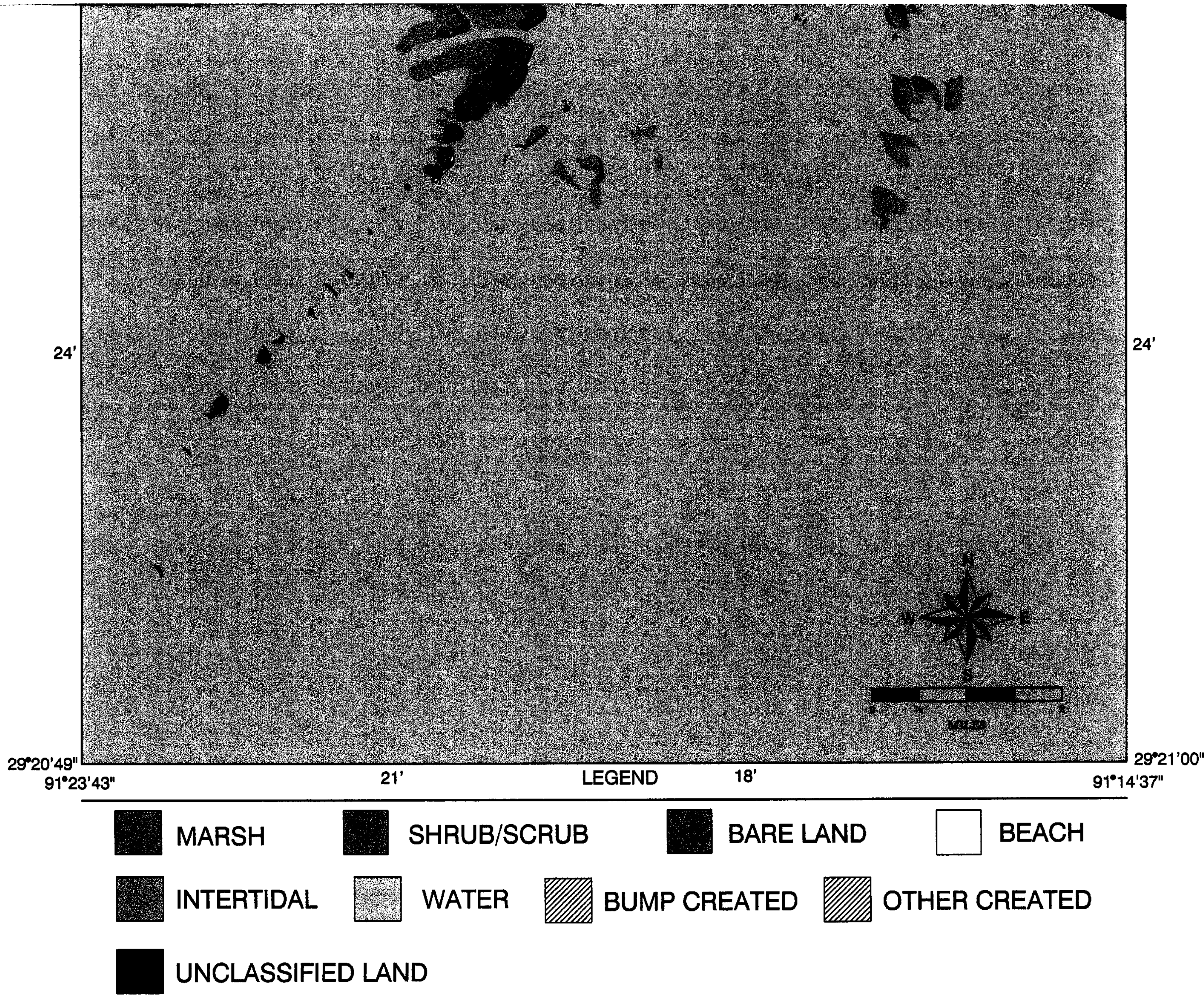
Table 1 lists the areas of the four habitat types found in the Atchafalaya River delta in December 1985. The location and arrangement of these habitats are presented in figure 19. The total area of the Atchafalaya delta was 1339.0 acres. Of this total, 231.9 acres were natural, 1064.5 acres were BUMP-related, and 4.26 acres were other man-made. In terms of habitat totals, shrub/scrub (613.5 acres) and fresh marsh (549.7 acres) dominated the landscape. Under natural conditions, the normal deltaic processes creates a greater percentage of fresh marsh than shrub/scrub. In contrast, under man-made conditions the dredged material disposal process created more shrub/scrub than fresh marsh. This was due to the intent and design of the man-made areas that were placed at a height and orientation to influence natural sedimentation and habitat development rather than directly create a specific habitat.

TABLE 1
December 1985 Habitat Inventory of the Atchafalaya Delta

HABITAT	TOTAL	NATURAL	BUMP MAN-MADE	OTHER MAN-MADE
Fresh Marsh	549.70	174.9	363.8	11.0
Shrub/Scrub	413.50	56.7	535.8	21.3
Bare Land	150.80	0.0	140.2	10.6
Beach	25.80	0.3	24.7	0.0
Habitat Total	1,339.00	231.9	1064.5	42.6

ATCHAFALAYA DELTA 1985




24'
24'
N
W
E
S
MILES
29°20'49"
91°23'43"
21'
18'
29°21'00"
91°14'37"
LEGEND
MARSH
SHRUB/SCRUB
BARE LAND
BEACH
INTERTIDAL
WATER
BUMP CREATED
OTHER CREATED
UNCLASSIFIED LAND

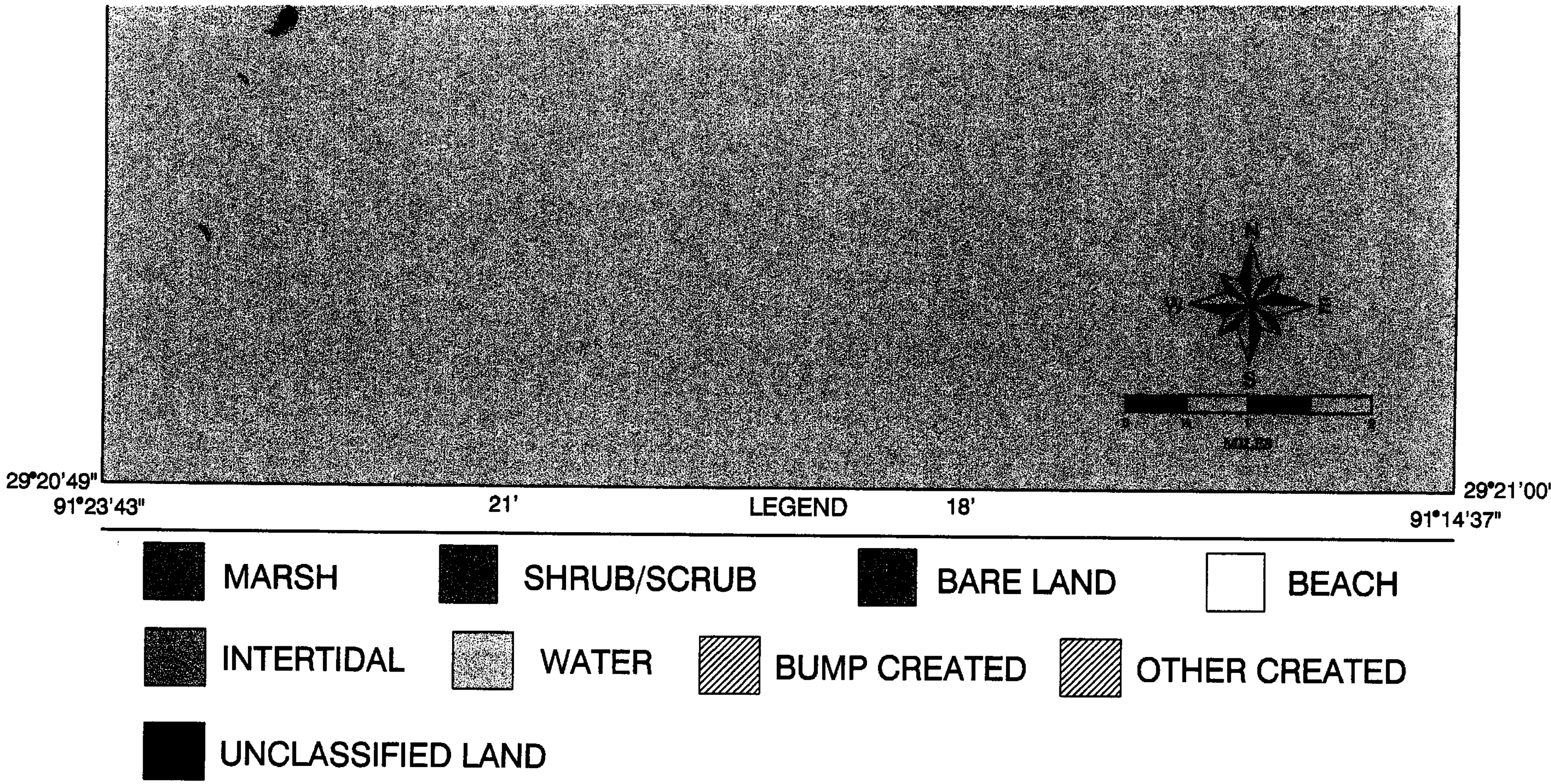


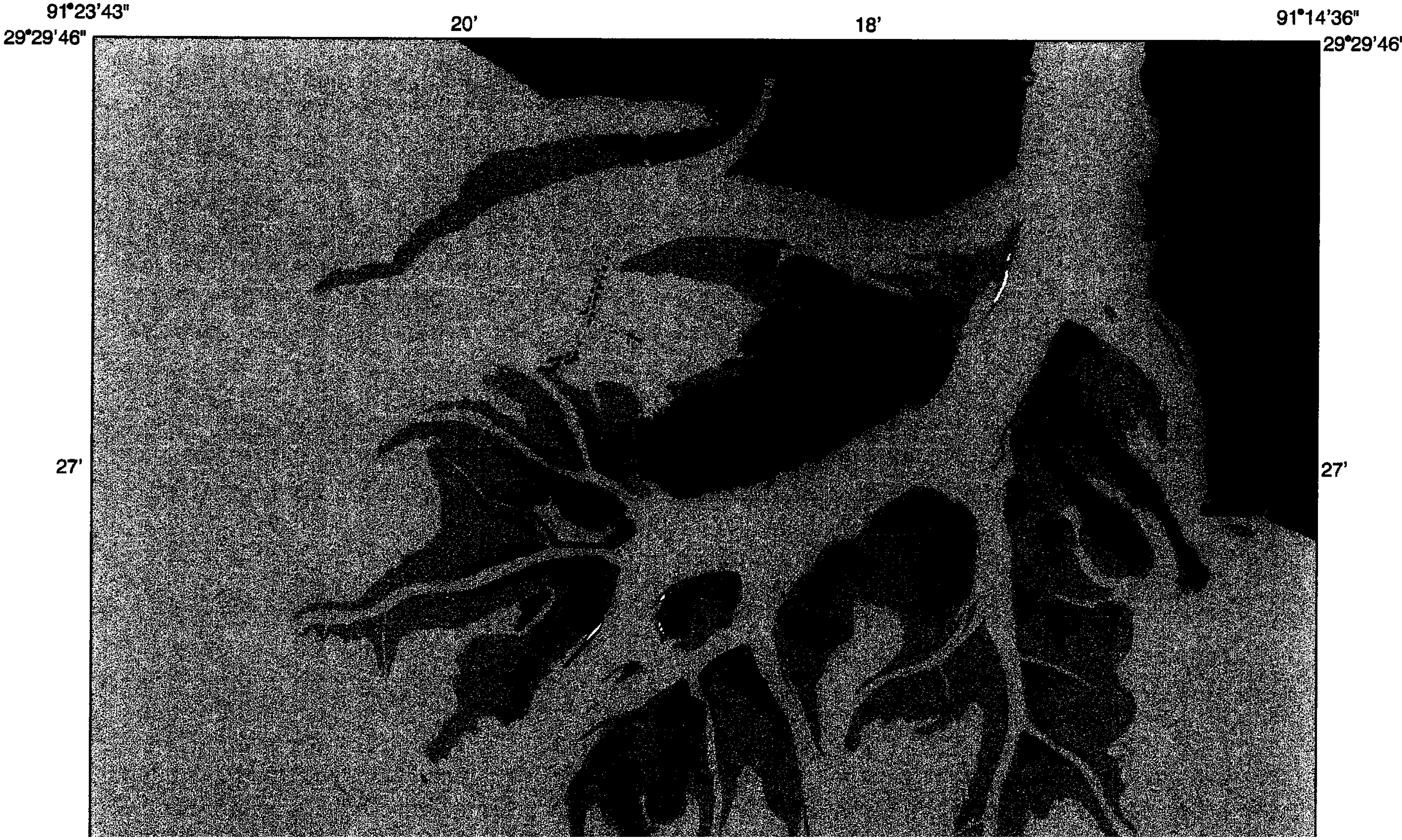
Figure 19. Habitat inventory map of the Atchafalaya delta in December 1985.

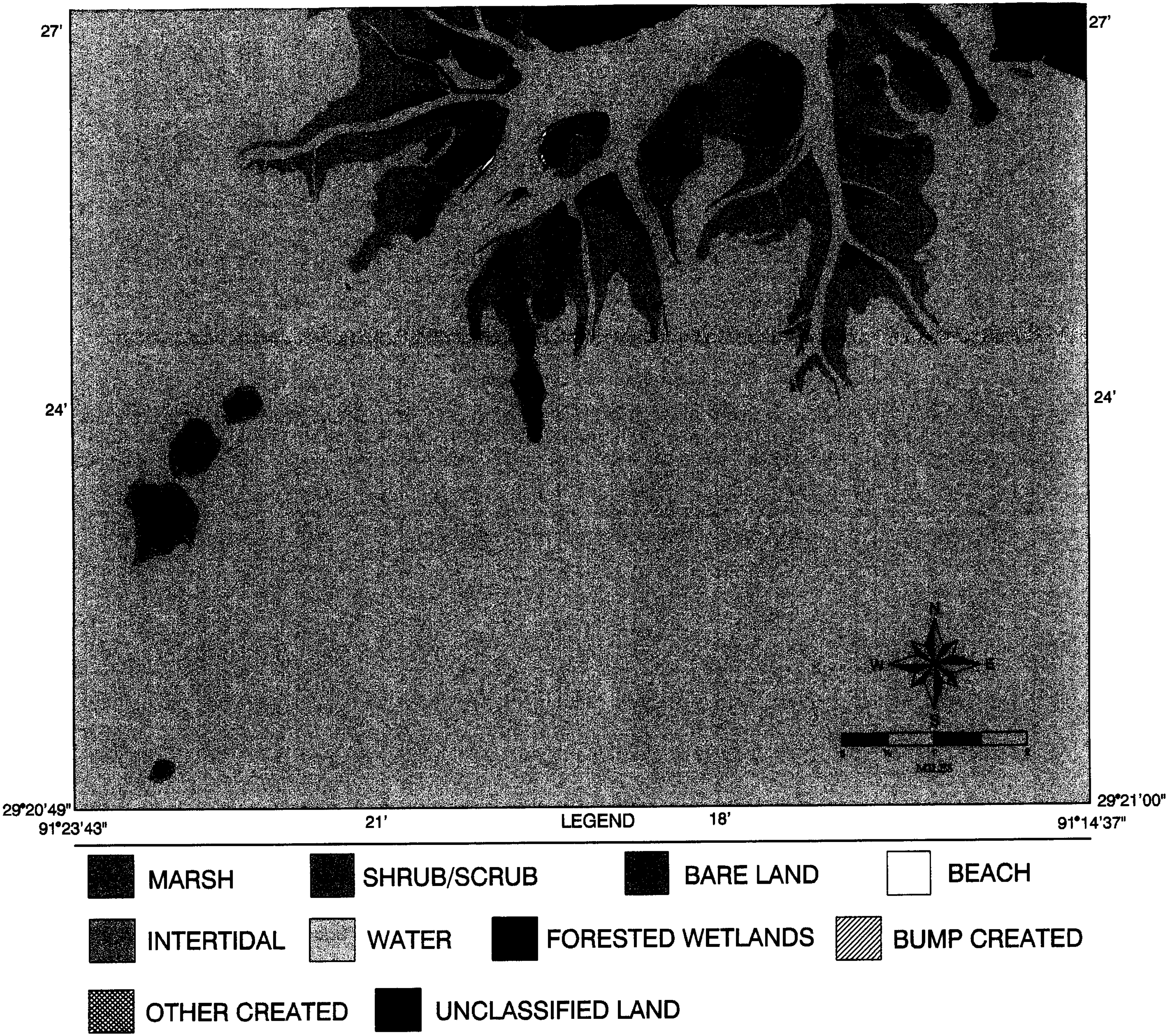
Table 2 lists the areas of the five habitats found in the Atchafalaya River delta in November 1994. The location and arrangement of these habitats is presented in figure 20. In 1994, the total area of the Atchafalaya delta was calculated at 4337.2 acres. Of this total, 1303.0 acres were natural, 2911.8 acres were BUMP-made, and 122.4 acres were other man-made. In terms of total area, fresh marsh (1864.0 acres) and forested wetland (954.7 acres), shrub/scrub (897.3 acres), and bare land (596.4 acres) dominated the landscape of the Atchafalaya delta. These areas were designed not to directly create marsh, but to direct sediment-laden water through existing natural channels to augment the natural delta-building process. Under natural conditions, the normal deltaic processes tend to create a greater percentage of fresh marsh than shrub/scrub.

TABLE 2
November 1994 Habitat Inventory of the Atchafalaya Delta

HABITAT	TOTAL	NATURAL	BUMP MAN-MADE	OTHER MAN-MADE
Marsh	1864.0	1218.9	623.0	22.1
Shrub/Scrub	897.3	79.6	788.9	28.8
Forested Wetland	954.7	0.0	883.2	71.5
Bare Land	596.4	0.0	596.4	--
Beach	24.8	4.5	20.3	--
Habitat Total	4337.2	1303.0	2911.8	122.4

ATCHAFALAYA DELTA 1994





27'
27'
24'
24'
29°20'49"
91°23'43"
21'
LEGEND
18'
29°21'00"
91°14'37"
N
W
E
S
MILES
MARSH
SHRUB/SCRUB
BARE LAND
BEACH
INTERTIDAL
WATER
FORESTED WETLANDS
BUMP CREATED
OTHER CREATED
UNCLASSIFIED LAND

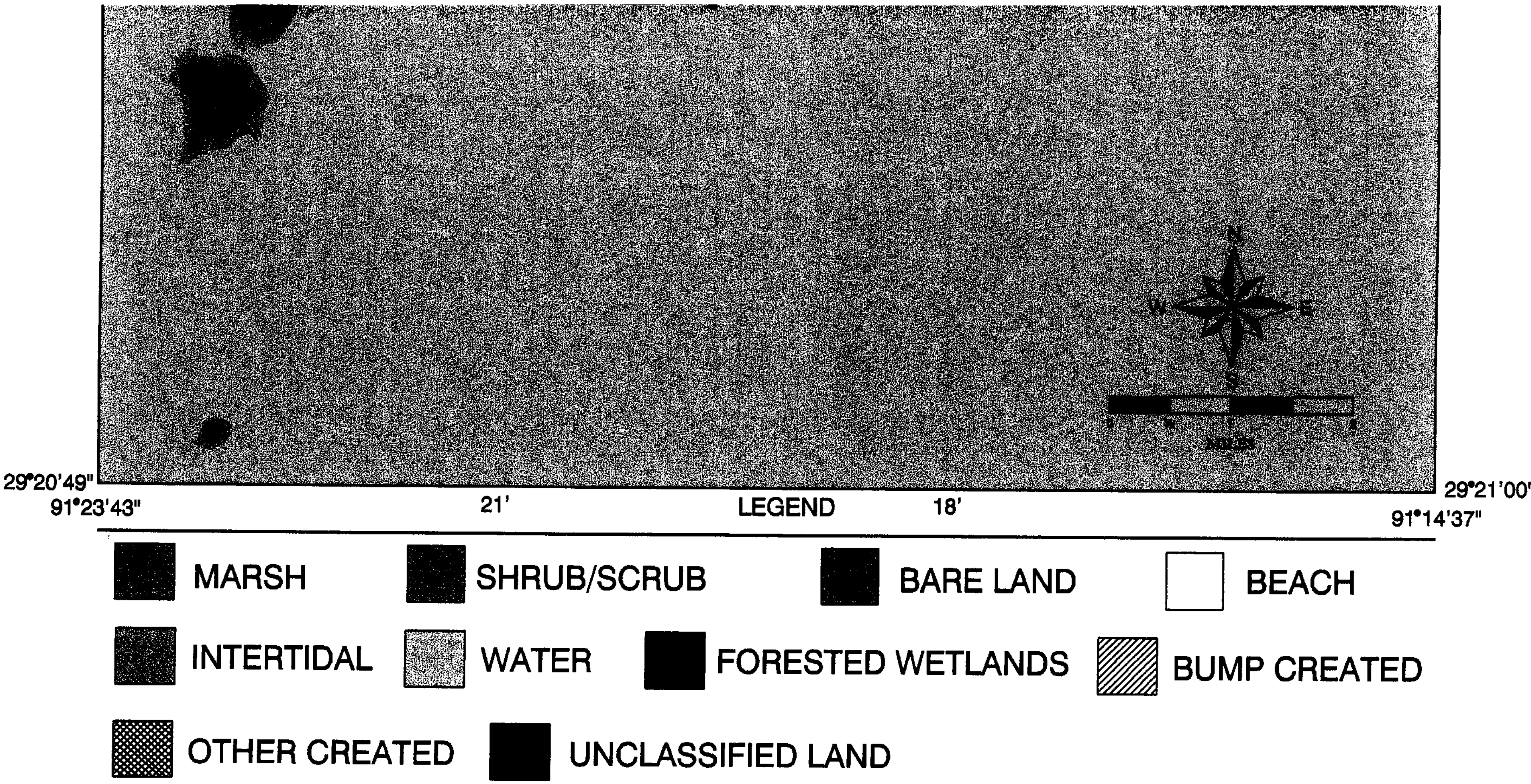


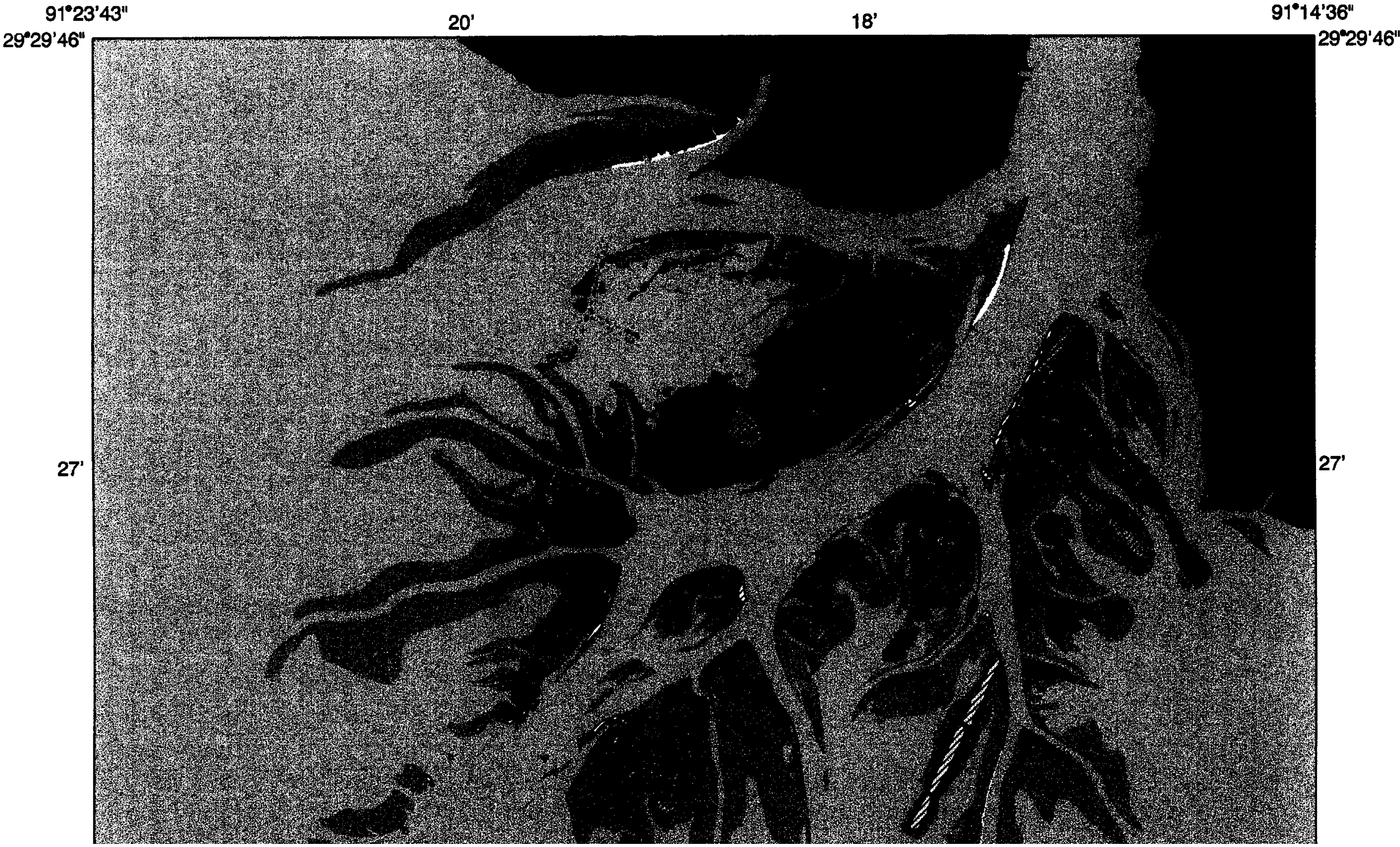
Figure 20. Habitat inventory map of the Atchafalaya delta in November 1994.

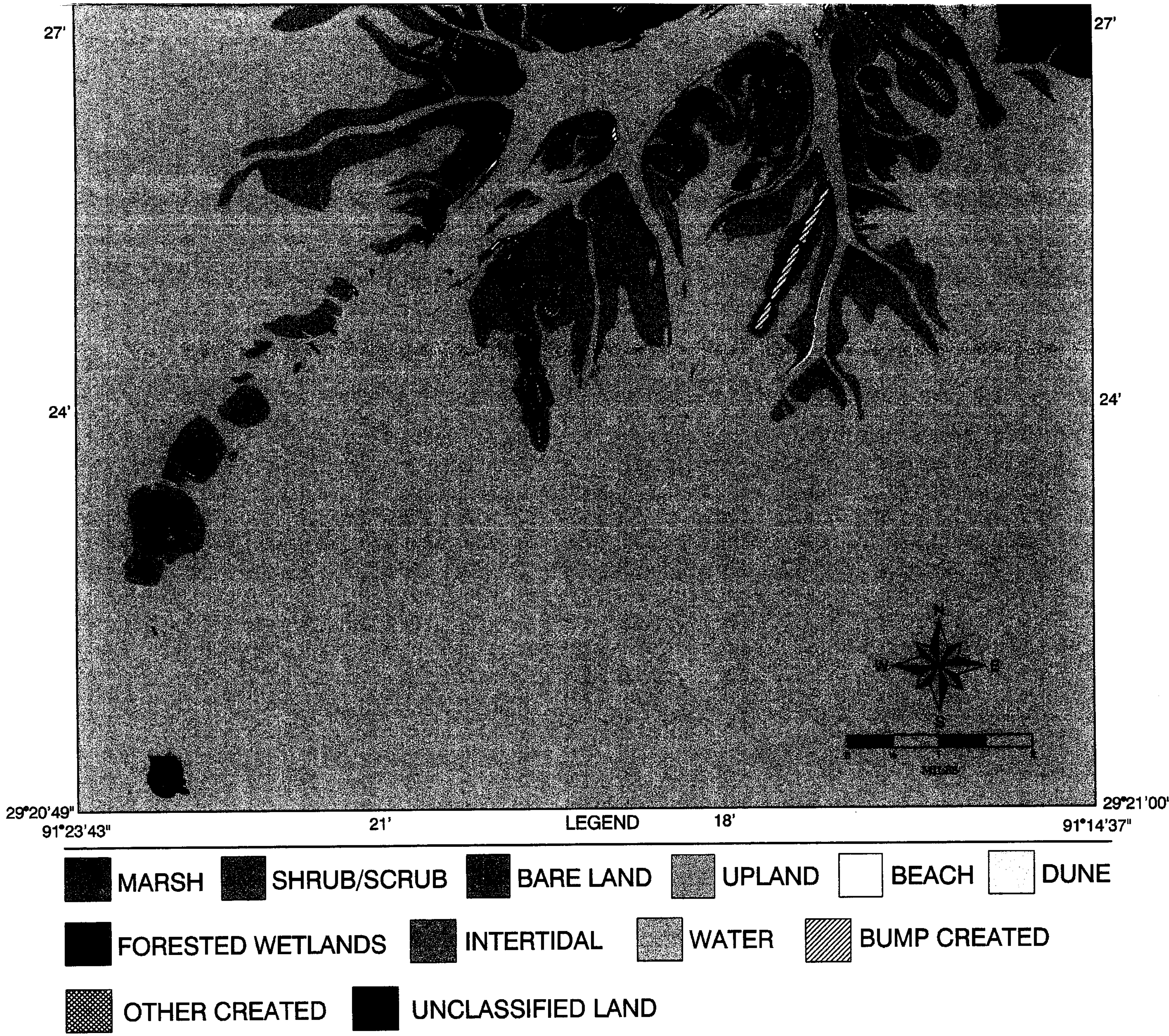
Table3 4 lists the areas of the seven habitats found in the Atchafalaya River delta in November 1995. The location and arrangement of these habitats is presented in figure 21. In 1995, the total area of the Atchafalaya delta was calculated at 5027.3 acres. Of this total, 1820.2 acres were natural, 3029.4 acres were BUMP-made, and 177.7 acres were other man-made. In terms of total area, fresh marsh (2412.7 acres) and forested wetland (1172.5 acres), shrub/scrub (760.3 acres), and bare land (269.0 acres) dominated the landscape of the Atchafalaya delta. These areas were designed not to directly create marsh, but to direct sediment-laden water through existing natural channels to augment the natural delta-building process. Under natural conditions, the normal deltaic processes tend to create a greater percentage of fresh marsh than shrub/scrub.

TABLE 34
November 1995 Habitat Inventory of the Atchafalaya Delta

HABITAT	TOTAL	NATURAL	BUMP MAN-MADE	OTHER MAN-MADE
Marsh	2412.7	1703.8	629.9	79.0
Upland	245.4	0.5	243.6	1.3
Shrub/Scrub	760.8	2.6	752.9	5.3
Forested Wetland	1172.5	79.6	1001.5	91.4
Bare Land	260.0	0.0	259.3	0.7
Dune	57.2	0.0	57.2	--
Beach	118.7	33.7	85.0	--
Habitat Total	5027.3	1820.0	3029.4	177.7

ATCHAFALAYA DELTA 1995





27'
27'
24'
24'
29°20'49"
91°23'43"
21'
18'
29°21'00"
91°14'37"
N
S
W
E
LEGEND
MARSH
SHRUB/SCRUB
BARE LAND
UPLAND
BEACH
DUNE
FORESTED WETLANDS
INTERTIDAL
WATER
BUMP CREATED
OTHER CREATED
UNCLASSIFIED LAND

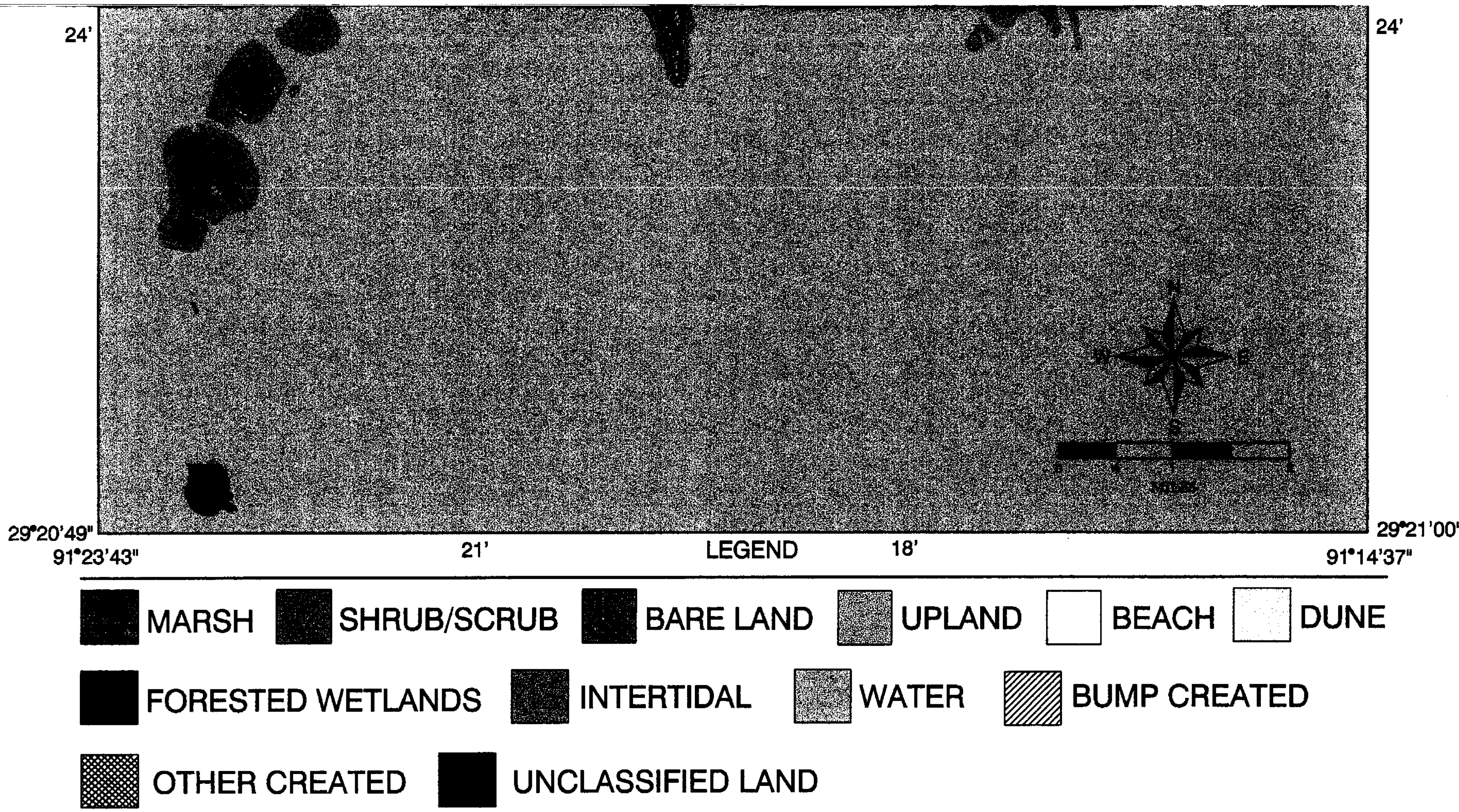


Figure 21. Habitat inventory map of the Atchafalaya delta in November 1995.

Table 4 lists the areas of the seven habitats found in the Atchafalaya River delta in November 1996. The location and arrangement of these habitats is presented in figure 22. In 1996, the total area of the Atchafalaya delta was calculated at 4445.2 acres. Of this total, 1222.9 acres were natural, 3035 acres were BUMP-made, and 186.5 acres were other man-made. In terms of total area, fresh marsh (1864.4 acres) and forested wetland (1230.2 acres), shrub/scrub (711.9 acres), and bare land (247.5 acres) dominated the landscape of the Atchafalaya delta. These areas were designed not to directly create marsh, but to direct sediment-laden water through existing natural channels to augment the natural delta-building process. Under natural conditions, the normal deltaic processes tend to create a greater percentage of fresh marsh than shrub/scrub.

TABLE 4
November 1996 Habitat Inventory of the Atchafalaya Delta

HABITAT	TOTAL	NATURAL	BUMP MAN-MADE	OTHER MAN-MADE
Marsh	1864.4	1120.0	671.8	72.6
Upland	331.0	0.0	317.8	13.0
Shrub/Scrub	711.9	18.0	689.5	4.4
Forested Wetland	1230.2	81.4	1052.7	96.1
Bare Land	247.5	3.5	243.7	0.3
Dune	39.5	0.0	39.5	--
Beach	20.7	0.0	20.7	--
Habitat Total	4445.2	1222.9	3035.8	186.5

ATCHAFALAYA DELTA 1996

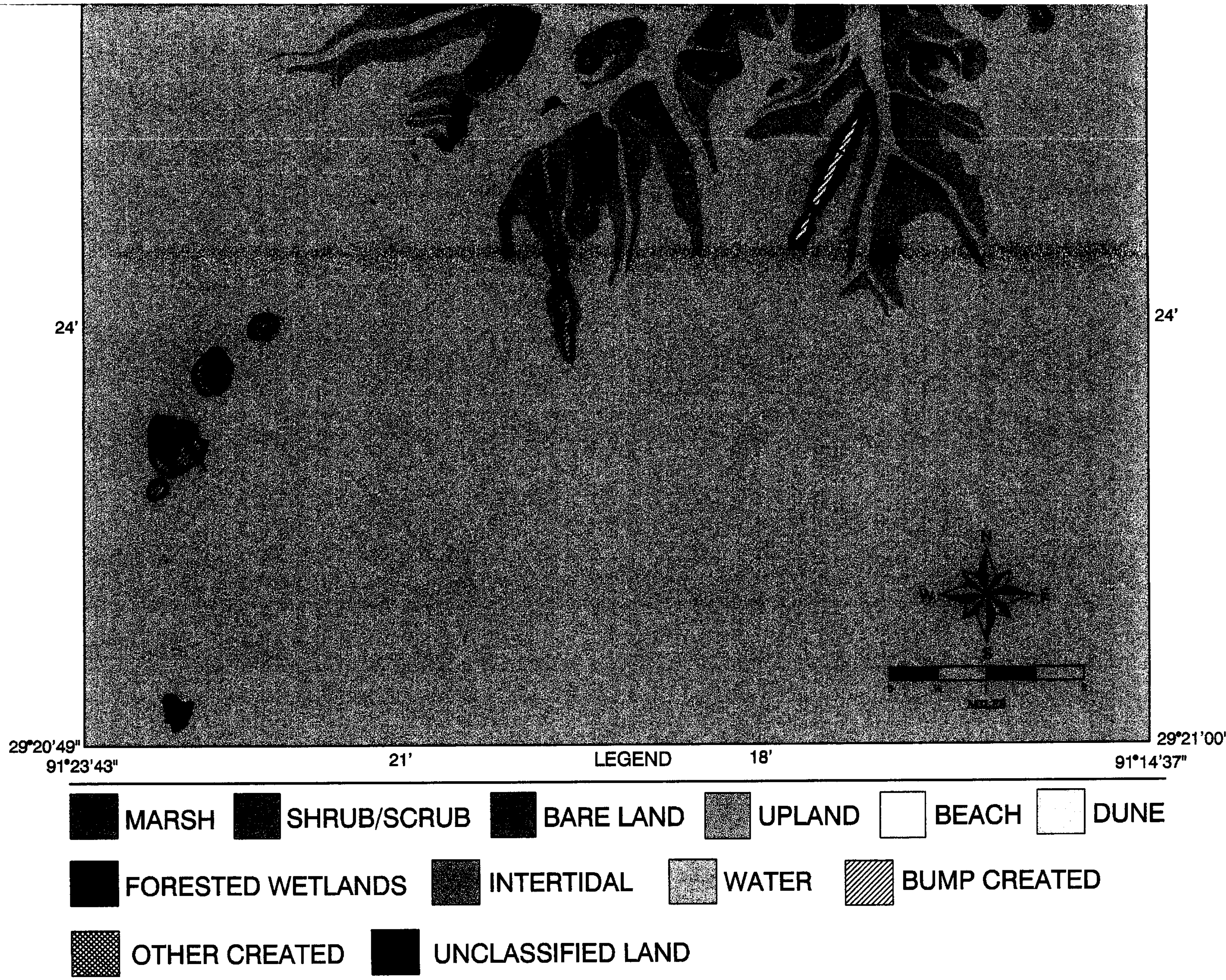


Figure 22. Habitat inventory map of the Atchafalaya delta in November 1996.

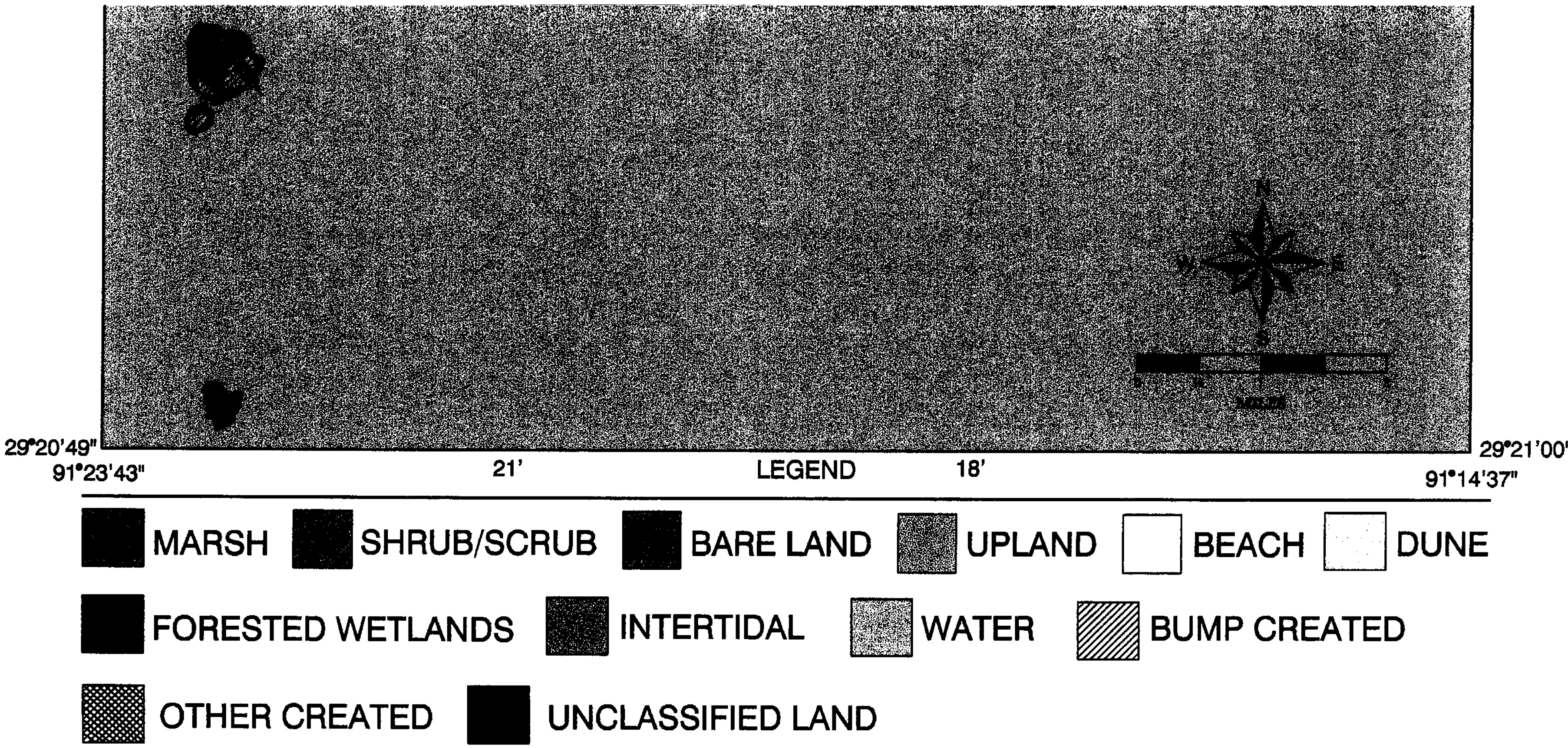
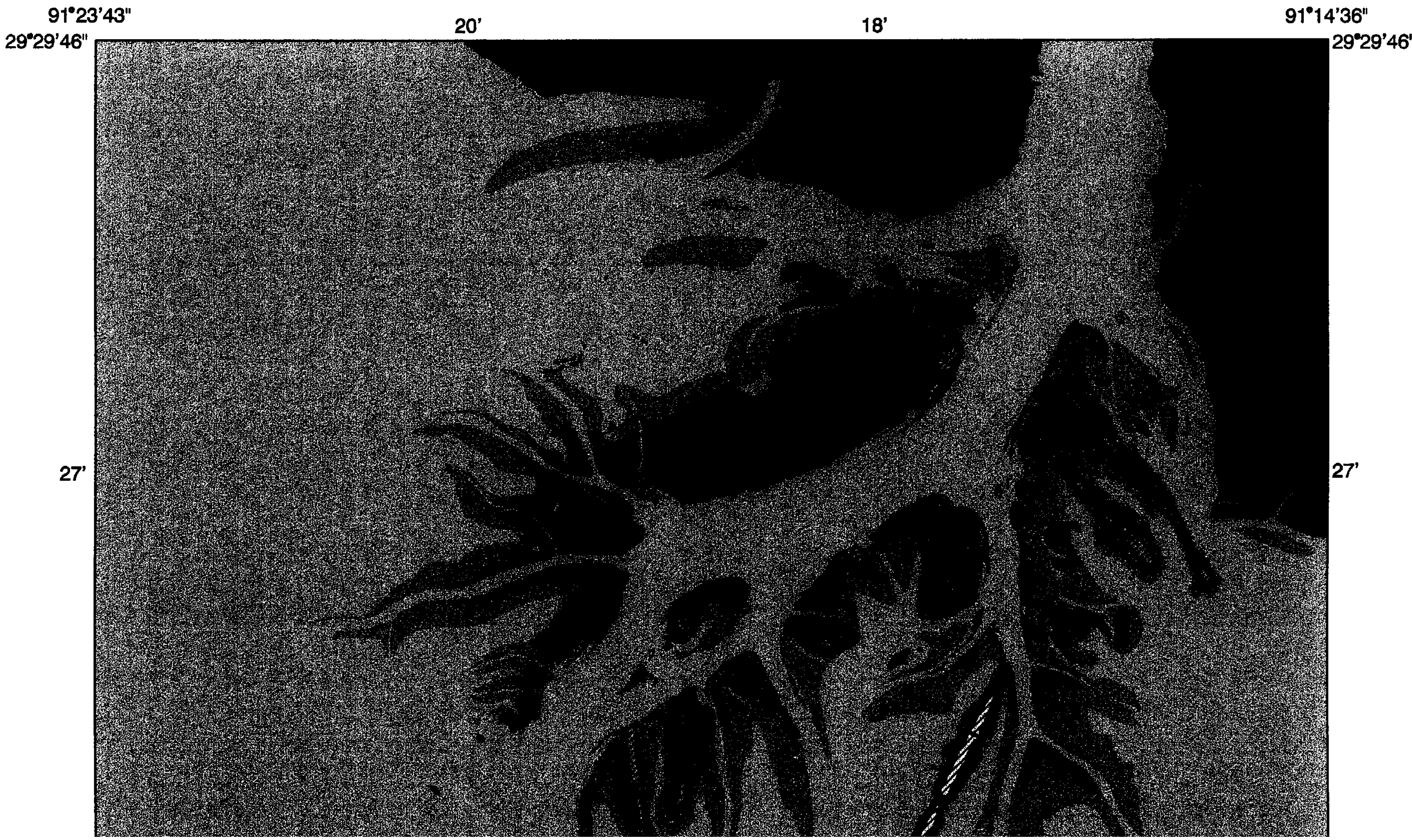


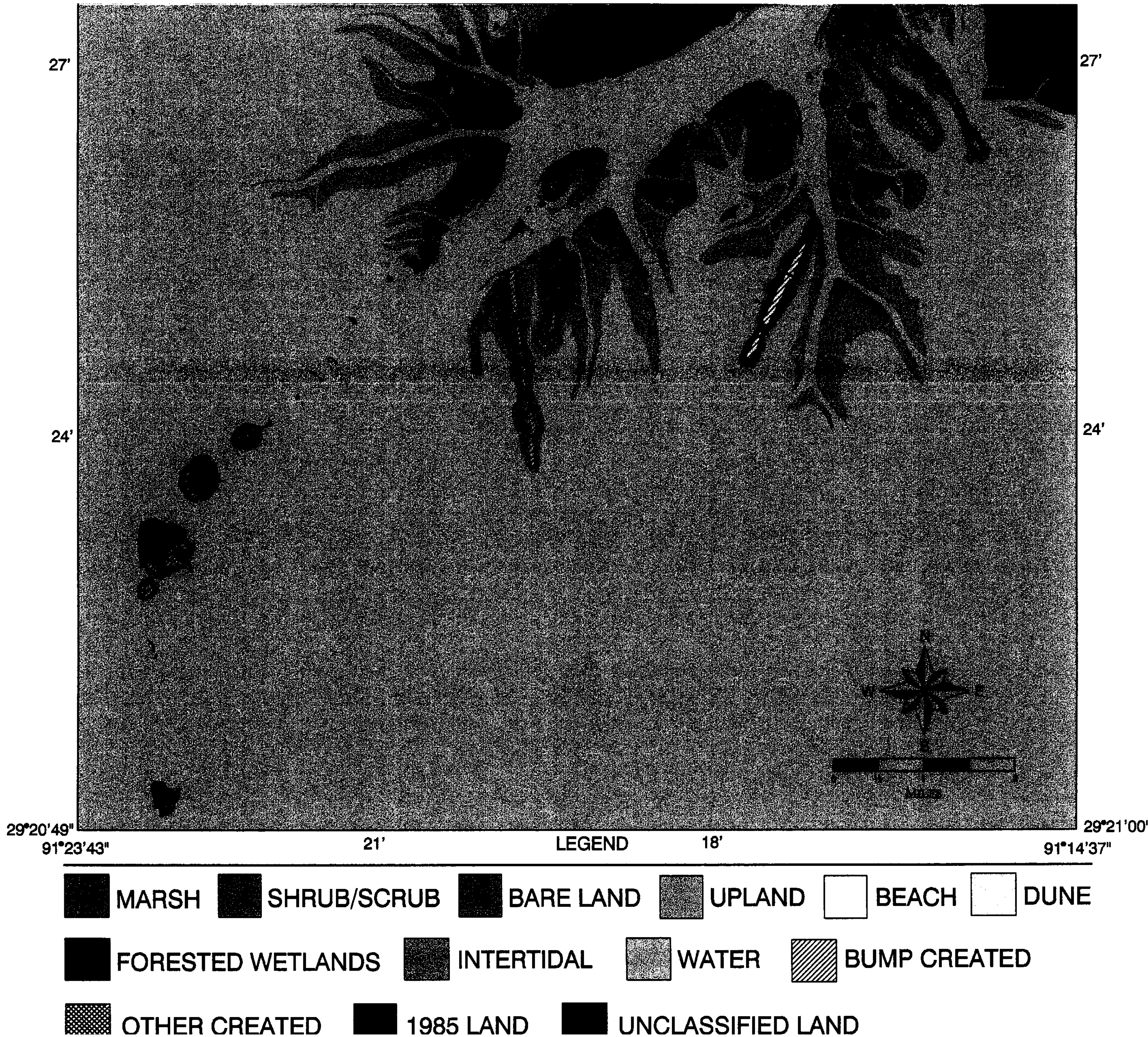
Figure 22. Habitat inventory map of the Atchafalaya delta in November 1996.

Habitat Change

Figure 22 shows the creation of new habitat, both natural and man-made, in the Atchafalaya delta by comparing December 1985 and November 1996. The total area increased by +2987.76 acres which represents a 230 percent increase in area between 1985 and 1996. Of this increase in area, 1134.55 acres were natural and 1853.21 acres were man-made by the placement of dredged material. Table 5 lists the major habitat changes. The major habitat-increase by natural processes was the increase in natural fresh marsh (+1061.83 acres). Other large increases occurred in the man-made habitats, include forested wetland (+960.23 acres), bare land (+450.75 acres), fresh marsh (+331.83 acres), and shrub/scrub (+128.40 acres). Figure 23 shows a time series of habitat changes in the Atchafalaya delta. In terms of dredged material placement, the greatest areas of new habitat creation include man-made forested wetland (+960.23), man-made bare land (+450.75 acres), and man-made shrub/scrub (+128.40 acres). Figure 23A graphs the natural habitat changes over time. Natural marsh development dominates the natural habitat class. Figure 23B graphs the man-made habitat changes over time. Forested wetland, man-made fresh marsh, man-made shrub/scrub and man-made bare land dominate the man-made class.

ATCHAFALAYA DELTA 1985 - 1996




27'
27'
24'
24'
N
W
E
S
MILES
29°20'49"
91°23'43"
21'
LEGEND
18'
29°21'00"
91°14'37"
MARSH
SHRUB/SCRUB
BARE LAND
UPLAND
BEACH
DUNE
FORESTED WETLANDS
INTERTIDAL
WATER
BUMP CREATED
OTHER CREATED
1985 LAND
UNCLASSIFIED LAND

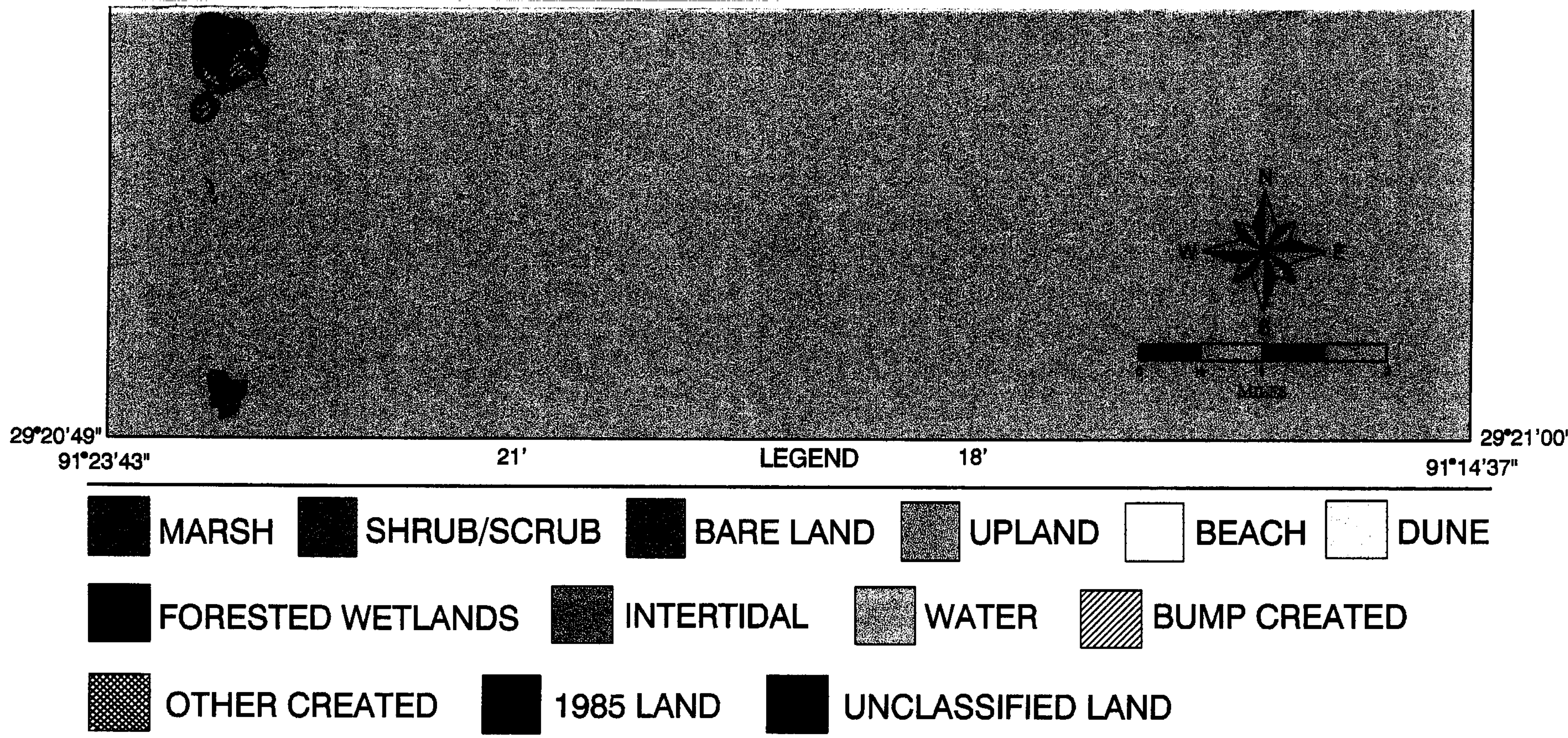
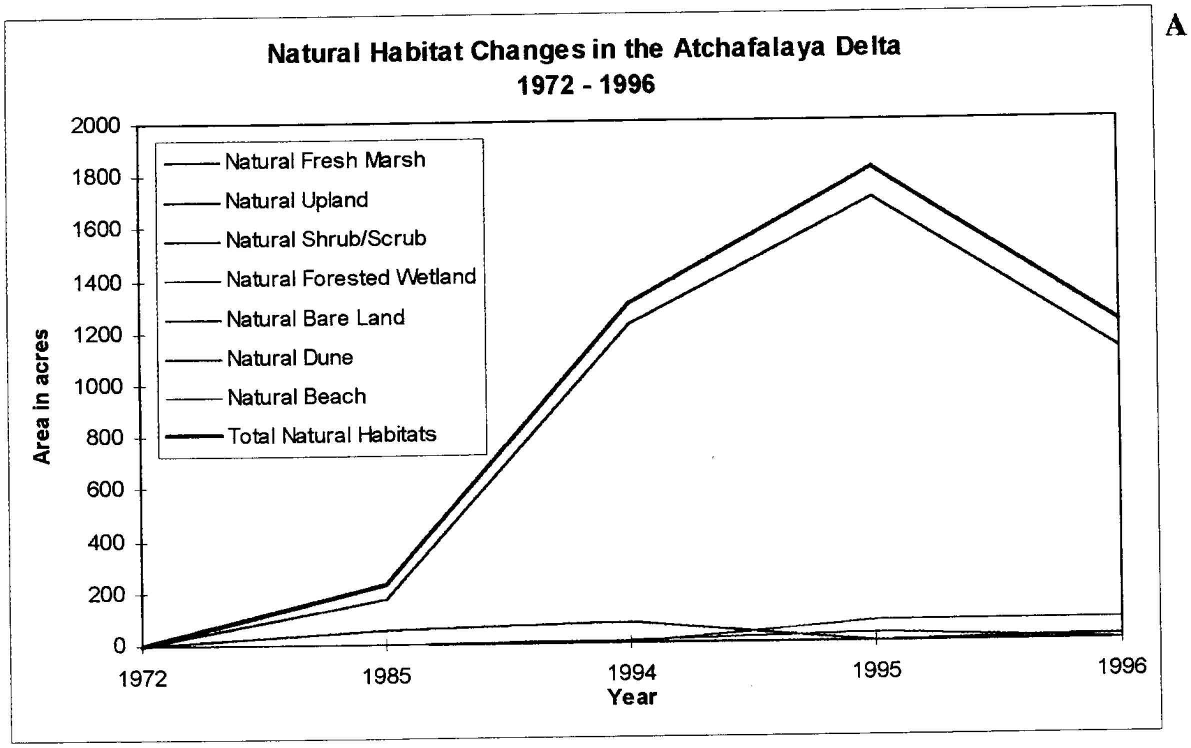


Figure 23. Map of the Atchafalaya delta showing the new habitats that developed between December 1985 and November 1996.

TABLE 5
Changes in Total Acres of Each Habitat in the Atchafalaya Delta between December 1985 and November 1996

HABITAT	1985[1]	1996[1]	AREA CHANGE[1]
Natural Marsh	174.9	1120.0	+945.1
Natural Upland	0.0	0.0	0.0
Natural Shrub/Scrub	56.7	18.0	-38.7
Natural Forested Wetland	0.0	81.4	+81.4
Natural Bare Land	0.0	3.5	+3.5
Natural Dune	0.0	0.0	0.0
Natural Beach	0.3	0.0	-0.3
Total Natural Habitats	231.9	1222.9	+991.0
BUMP-made Marsh	363.8	671.8	+308.0
BUMP-made Upland	0.0	317.9	+317.9
BUMP-made Shrub/Scrub	535.8	689.5	+153.7
BUMP-made Forested Wetland	0.0	1052.7	+1052.7
BUMP-made Bare Land	140.2	243.7	+103.5
BUMP-made Dune	0.0	39.5	+39.5
BUMP-made Beach	24.7	20.7	+1052.7
Total BUMP-made Habitats	1064.5	3035.8	+1971.3
Other man-made Marsh	11.0	72.6	+61.6
Other man-made Upland	0.0	13.1	+13.1
Other man-made Shrub/Scrub	21.0	4.4	-16.6
Other man-made Forested Wetland	0.0	96.1	+96.1
Other man-made Bare Land	10.6	0.3	-10.3
Other man-made Dune	0.0	0.0	0.0
Other man-made Beach	0.0	0.0	0.0
Total Man-made Habitats	42.6	186.5	+143.9
Habitat Total	1339.0	4445.2	+3106.2

[1]Acres



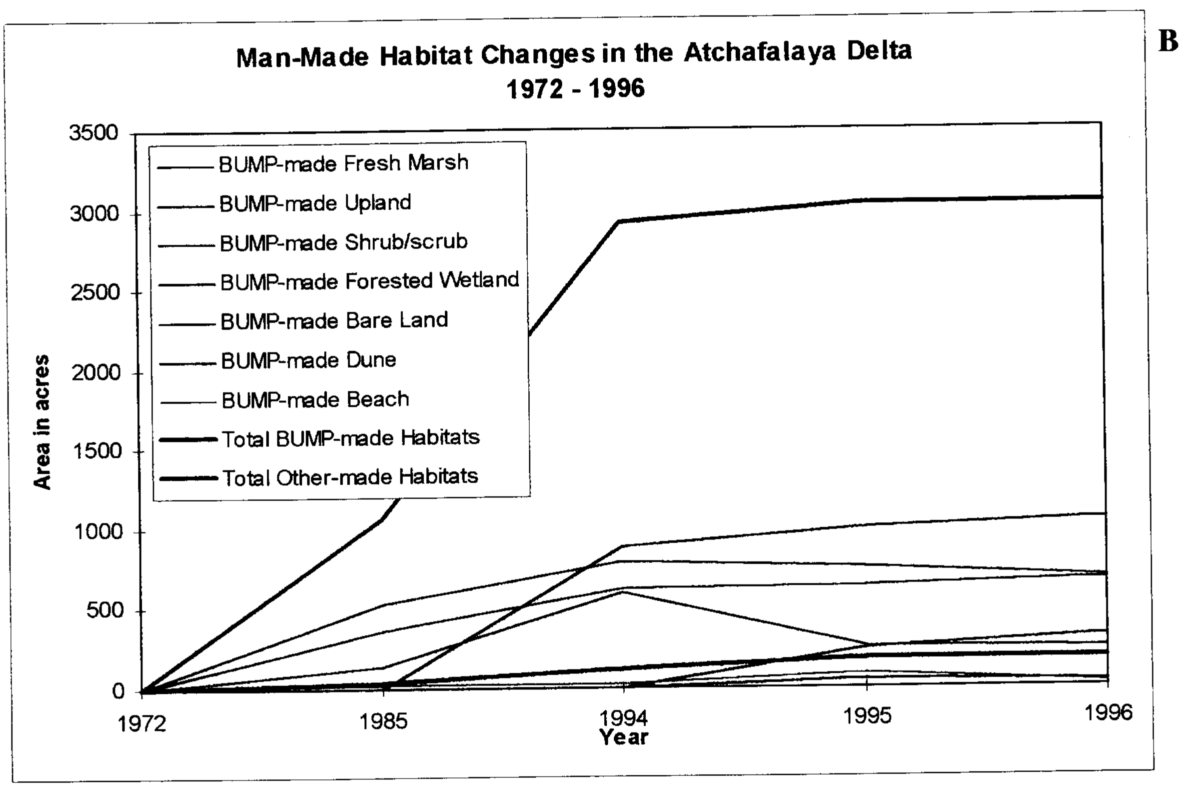


Figure 24. Time series showing the changes in total area of each habitat in the Atchafalaya River delta between 1972 and 1996. A) natural habitat changes. B) man-made habitat changes.

CONCLUSIONS

1. The total area of the Atchafalaya River delta in December 1985 was 1339.0 acres. Natural processes accounted for 231.9 acres or 17 percent of the total area. BUMP-made processes related to placement of dredged material accounted for 1064.5 acres or 79 percent of the total area. Other man-made processes accounted for 42.6 acres or 4 percent of the total areas.

2. The total area of the Atchafalaya River delta in November 1996 was 4445.2 acres. Natural processes accounted for +1222.9 acres or 28 percent of the total area. Man-made processes related to the beneficial use of dredged material accounted for +3035.8 acres or 68 percent of the total area. Other man-made processes accounted for 186.5 acres or 4 percent of the total area.

3. The Atchafalaya River delta increased by +3106.2 acres between December 1985 and November 1996. Natural processes were responsible for +991.0 acres of increase and the beneficial placement of dredged material was responsible for +1971.3 acres of this increase. Other man-made processes accounted for +143.9 acres of this increase.

4. Natural processes appear to be effective in creating marsh. Beneficial use of dredged material appears to be effective in creating a variety of habitats, including forested wetland, shrub/scrub, bare land, and fresh marsh.

5. The field surveys indicate the current stacking heights are optimal for establishing forested wetland and shrub/scrub habitats and to a lesser extent fringing marshes. The optimal elevation for marsh creation appears to be less than +2 feet MSL. The average elevation of Andrew Island is +3.02 feet. The average elevation of eastern Horseshoe Island is +2.25 feet. The average elevation of Ibis Island is +2.21 feet.

6. The greatest rates of shoreline progradation in the Atchafalaya River delta are associated with the placement of dredged material. Natural processes prograde the Atchafalaya River delta at a rate of about +300 feet per year and man-made processes prograde the shoreline at a rate of about +500 feet per year.

REFERENCES

Van Heerden, Ivor L., 1994. Natural and dredged material sedimentation in Atchafalaya delta, Louisiana. Contract Report for Environmental Protection Agency. 45 pp.

Penland, S. and Westphal, K.A., 1997. 1996 beneficial use monitoring program annual report; Part 1: Methodology. Report to the US Army Corps of Engineers - NOD. 16 pp.

APPENDIX 9A

LIST OF VEGETATIVE SPECIES IN THE ATCHAFALAYA DELTA

LIST OF VEGETATIVE SPECIES IN THE ATCHAFALAYA DELTA

An alphabetical list of observed and collected plant species follows. This list is not complete, but is meant to establish vegetative character and indicate dominant species observed. The list includes the species name, alternate scientific names, common names, and general habitat description for each plant. The habitat information was taken from the Manual of the Vascular Flora of the Carolinas or The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts. Common names were from a variety of sources.

Acmella oppositifolia (Lam.) R.K. Jansen var. **repens** . . . . creeping Spotflower
(Spilanthes americana)
colonial perennial; wet pastures, swamp forests, river banks

Acnida tamariscina (Nutt.) Wood. . . . . water-hemp
(Amaranthus tamariscinus) annual; brackish marshes

Aeschynomene indica L. . . . . joint-vetch shrub
annual; swamps, marshes, and ditches

Alternanthera philoxeroides (Mart.) Griseb. . . . . alligator-weed
perennial; fresh or intermediate aquatic or very wet habitats

Asclepsis sp. . . . . milkweed
perennial herbs

Aster subulatus Michx . . . . annual saltmarsh aster
annual; fresh to brackish marsh

Baccharis halimifolia L. . . . . groundselbush
shrub or small tree; elevated sites in fresh to saline marshes

Bacopa caroliniana (Walter) Robinson . . . . blue water-hyssop
succulent creeping herb; sandy, shallow pond and marsh or moist stream margins

Bacopa monnieri (L.) Pennell . . . . coastal water-hyssop
succulent creeping herb; sandy margins of fresh or brackish marshes, streams, ponds

Boehmeria cylindrica (L.) Sw. . . . . False-nettle
perennial; moist or wet soil under shrubs or trees or in open, flats, marshes

Callibrachoa parviflora (Juss.) D'Arcy . . . . wild petunia
(Petunia parviflora)
perennial; roadsides and waste places

Chamaesyce maculata (L.) Small . . . . prostrate spurge
erect or prostrate annual; along paths, crevices and sides of sidewalks and roads, waste places

Colocasia antiquorum . . . . elephantsear
perennial; freshwater marsh, pond and stream margins

Conyza bonariensis (L.) Cronq. . . . . hairy fleabane
(Erigeron bonariensis)
winter annual; fields and waste places

Conyza canadensis (L.) Cronq . . . . horseweed
annual; fields, roadsides, pastures and waste places

Cynodon dactylon (L.) Pers. . . . . Bermuda grass
rhizomatous perennial; fields, roadsides, waste places
Cyperus aristatus Rottb. . . . .
Annual; sandy fields
Cyperus elegans L. . . . . nut sedge
fresh to intermediate marsh, sand lake and bayshore
Cyperus esculentus L. . . . . yellow nutgrass
perennial; sandy fields, roadsides, and waste places
Cyperus oxylepis Steud. . . . .

Cyperus surinamensis Rottb. . . . .
Rhizomatous perennial; disturbed clay-sand beds
Digitaria ciliaris (Retz.) Koel. . . . . crab grass
annual; sandy fields, roadsides, waste places
Echinochloa crusgalli (L.) Beauv. . . . . barnyard grass
coarse annual; low fields, marshes and waste places
Echinochloa walteri (Pursh) Heller . . . . Walter's millet
coarse annual; fresh and intermediate marshes and low waste places
Eclipta prostrata (L.) L. (Eclipta alba) . . . . Yerba de Tajo
annual herb; pond shores, alluvial meadows, marshes, low woods and bogs
Eichhornia crassipes Kunth . . . . water hyacinth
floating aquatic; freshwater ponds and waterways
Eleocharis parvula (R. & S.) Link . . . . dwarf spikerush
perennial; brackish marshes, rarely fresh-water marshes
Equisetum hyemale L. var. **affine** (Engelm.) A.A.Eaton . . . . scouring rush
rhizomatous; railroad embankments, roadsides and stream banks
Erigeron philadelphicus L. . . . . daisy fleabane
perennial herb; old fields, meadows and waste ground
Eupatorium capillifolium (Lam.) Small . . . . yankee weed, dog fennel
annual; fields, meadows, pastures and disturbed woods
Galium tinctorium L. . . . . dye bedstraw
annual; swamps, meadows, marshes and wet ditches
Heliotropium curassavicum L. . . . . seaside heliotrope
annual succulent; seashores and borders of fresh to saline marsh
Heliotropium procumbens Mill. . . . . marsh heliotrope
annual succulent
Hydrocotyle bonariensis Lam. . . . . sand pennywort
creeping perennial; among beach dunes, moist open sandy areas
Hydrocotyle ranunculoides L.f. . . . . pennywort
aquatic or semi-aquatic perennial; seepage areas, pools, stream margins and swamps
Hydrocotyle umbellata L. . . . . marsh pennywort
creeping perennial; low or moist areas
Hymenocallis crassifolia Herbert. . . . . spider lily
perennial bulb; brackish marshes, low woods and swamp forest borders
Iris giganticaerulea . . . . giant blue flag
rhizomatous perennial; fresh marshes, swamps, and stream margins

Iva annua L. . . . .
Erect annual herb; fields and waste places

Juncus effusus L. . . . . soft rush
perennial; moist soil, edges of swamps and ponds, low pastures

Juncus tenuis Wiild. . . . . path rush
perennial; dry or moist soil along roadsides and paths

Leptochloa fascicularis (Lam.) Gray . . . . bearded sprangletop
tufted annual; lakebed, fresh to brackish marsh,
best in intermediate marsh subject to drying

Leptochloa uninervia (Presl) Hitchc. & Chase . . . . Mexican sprangletop
tufted annual; waste places

Medicago polymorpha L. . . . . bur clover
annual; fields, roadsides and waste places

Mikania scandens (L.) Willd. . . . . climbing hempweed
perennial vine; woods, thickets, marshes and bogs, usually very wet habitats

Modiola caroliniana(L.) G.Don . . . . Carolina mallow
creeping perennial; lawns, gardens, pastures, roadsides and seepage slopes in woods

Panicum dichotomiflorum Michx. . . . . fall panicum,
tufted annual; fresh and intermediate marsh, ditches, low woods zig-zag grass

Panicum repens L. . . . . dogtooth grass
perennial grass; fresh and intermediate marsh , slightly elevated sites torpedo grass

Paspalum distichum L. . . . . "red-stem paspalum"
mat-forming perennial; brackish and freshwater marshes

Paspalum urvillei Steud. . . . . Vasey grass
perennial grass; roadsides, fields and waste places

Phyla nodiflora (L.) Greene . . . . frog-fruits
decumbent perennial; sandy open habitats,usually moist, swales, ditches, pond margins

Polygonum lapathifolium L. . . . . willow-weed
annual; alluvial fields, river banks, disturbed habitats

Polypogon monspeliensis (L.) Desf. . . . . rabbitfoot grass
annual; brackish marshes

Ranunculus sceleratus L. . . . . buttercup
succulent annual; marshes and ditches

Rorippa palustris (L.) Besser . . . . yellow cress
biennial or perennial herbs; wet habitats about ponds, lakes, and streams

Sacciolepis striata (L.) Nash . . . . cupscale
creeping perennial; marshes, swales, sloughs, ditches, pond margins, depressions

Salix nigra Marshall . . . . black willow
tree; streambeds and low moist areas

Samolus valerandii L. subsp. **parviflorus** (Raf.) Hulten . . . . water pimpernel
annual or perennial; wet habitats, fresh or brackish

Scirpus americanus Pers. . . . . American bulrush,
perennial; fresh to intermediate marsh, sandy lake and bayshore freshwater three-square

Scirpus validus Vahl. . . . . softstem bulrush
creeping perennial; (S. tabernaemontani K.G. Gmel)
marshes and rocky streambeds

Senecio glabellus Poir. . . . . butterweed
annual; alluvial woods, swamp forests and wet pastures

Sesbania drummondii (Rydb) Cory. . . . . yellow rattlebox
(Daubentonia longifolia (Cav.) DC.)
shrub; elevated areas in fresh to saline marsh

Sesbania exaltata (Raf.) Rydb. . . . .
Annual shrub to 4m; ditches, edge of brackish and fresh marshes, swales, edge of sloughs, fields, alluvial soils

Sibara virginica (L.) Rollins . . . . winter cress
winter annual; disturbed soils, mostly in low fields

Solanum americanum P. Mill. (or **S. ptychanthum** Dunal) . . . . nightshade
annual; woodland margins, fields, roadsides and waste places

Solidago sp. . . . . goldenrod
perennial herbs

Solidago sempervirens L. . . . . seaside goldenrod
perennial; brackish marsh or saline sand

Spergularia echinosperma Celak (or **S.marina** (L.) Griseb. . . . . sand spurrey
tufted annual; salt marshes and tidal flats

Tamarix gallica L. . . . . sea-side cedar, tamarisk
shrub or small tree; escaped to sandy roadsides and waste places

Trifolium dubium Sibthorp . . . . low hop clover
annual; lawns, fields, roadsides and waste places

Trifolium hybridum L. . . . . Alsike clover
perennial; lawns, fields, roadsides, swales between stable dunes

Urtica chamaedryoides Pursh . . . . stinging nettle
stinging annual; rich woods over circumneutral soil, rare

Zizaniopsis miliacea (Michx.) Doell & Asch. . . . . southern wild rice, water millet
rhizomatous perennial; brackish and freshwater marshes